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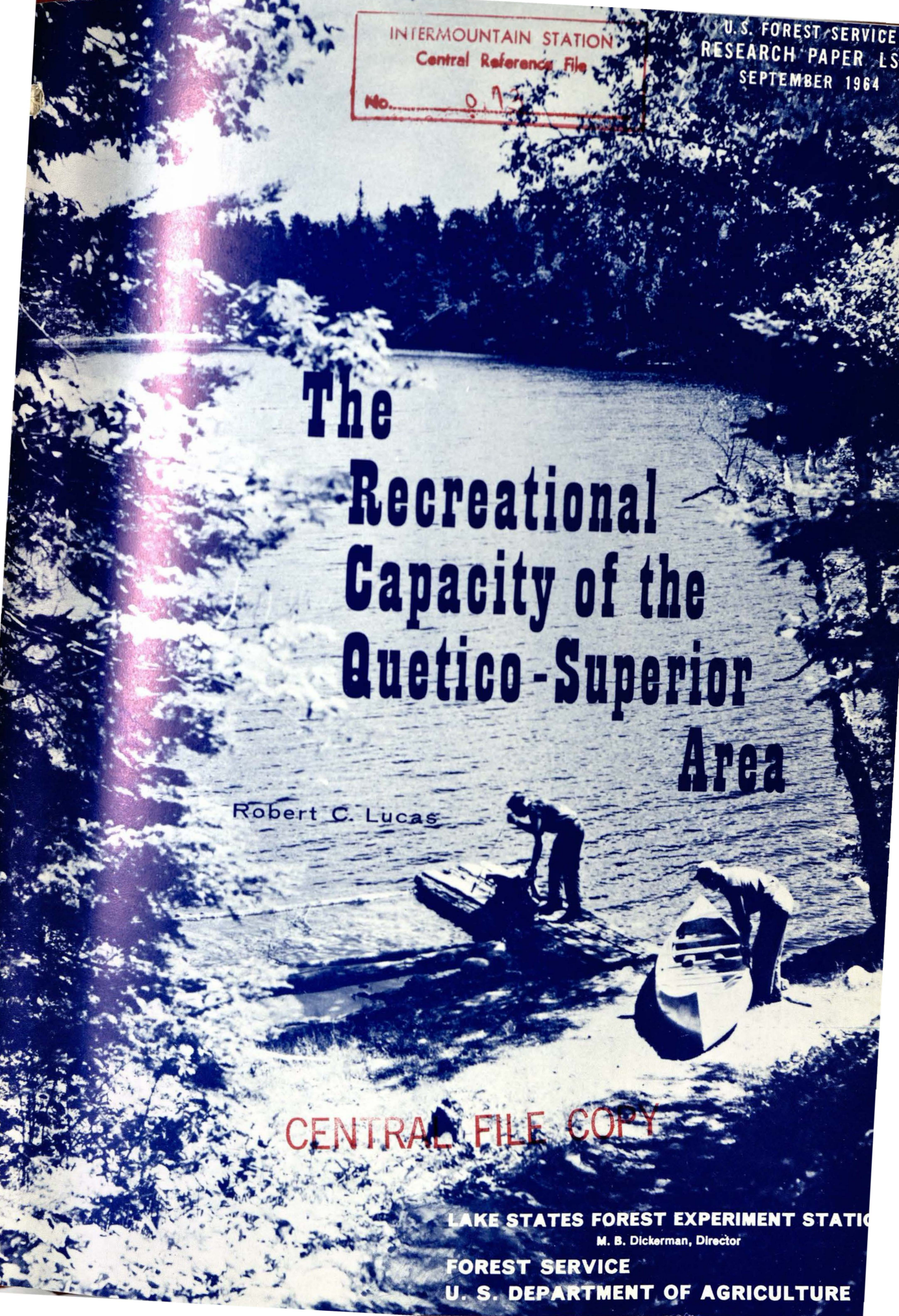
The Recreational Capacity of the Quetico-Superior Area

Robert C. Lucas



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LAKE STATES FOREST EXPERIMENT STATION
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FOREWORD

Early in 1964 the Lake States Forest Experiment Station published a report on "Recreational Use of the Quetico-Superior Area" by Dr. Robert C. Lucas. It showed the amounts and distribution of different kinds of uses, discussed the factors related to distribution, and outlined trends in use.

In the report presented here, Dr. Lucas attempts to relate the use patterns and trends to the area's capacity for producing wilderness experience for visitors. The work is an interpretation of user viewpoints and activities in terms of land management implications. Such interpretations need to be considered, along with biological, economic, legal, and other factors, in setting management policies.

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INTRODUCTION

The Problem

An important and probably essential characteristic of a wilderness is limited use. Crowds are absent, and man's mark on the landscape is minor. But more and more people go to the wilderness each year, and the press of numbers threatens to wipe out the wilderness qualities. This was recognized by Aldo Leopold, one of the major contributors to the stream of ideas which has led to the establishment of 84 National Forest wilderness-type areas covering over 14 million acres. He wrote (1949, p. 101): "Thus always does history, whether of marsh or marketplace, end in paradox. The ultimate value of these marshes is wildness. . . . But all conservation of wildness is self-defeating, for to cherish we must see and fondle, and when enough have seen and fondled, there is no wildness left to cherish."

If conservation of wildness is not to be self-defeating, there must be a compromise between complete wilderness with no visitors and, at the other extreme, crowds and no wilderness. Neither extreme provides any wilderness experience; some middle ground is unavoidable if the well-established social goal of providing an opportunity to experience wilderness is to be maintained. But where is the middle ground?[1]

The problem of climbing recreational use and retreating wilderness is general (fig. 1). At present, however, probably only a few more frequently visited wilderness regions are near the critical zone on the compromise spectrum. The Quetico-Superior Area is one of these heavily used wilderness regions (Lucas, 1964a). The portion of the Quetico-Superior Area in the United States, the Boundary Waters Canoe Area of the Superior National Forest, is the most used Forest Service wilderness-type area in terms of visits and man-days, and one of the most used on a man-days-per-acre basis, according to official use estimates. Use of the Canadian portion, Ontario's Quetico Provincial Park, is less, but still substantial, and some parts are heavily used (Lucas, 1964a).

The wilderness areas under the heaviest pressure are good subjects for wilderness capacity research. Here the limits to wilderness use should be most apparent, and findings should have application to future conditions for wilderness now lightly travelled but with an expected rapid increase in use. Official estimates of wilderness visits to the National Forests show a higher rate of increase than do figures for conventional recreational visits, and projections suggest that this gap will widen substantially. A tenfold increase in wilderness man-days of use has been projected for 2000, and an eightfold growth for the Boundary Waters Canoe Area (Wildland Research Center, 1962, p. 236). In contrast, only a threefold increase has been projected for all outdoor recreation by the same date, and a fourfold expansion for general camping (Outdoor Recreation Resources Rev. Comn., 1962, p. 46).

Preview of Study and Results

There are three parts to the study reported here. First, the factors limiting capacity are considered. The physical factors are discussed only

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FIGURE 1. — As more people seek the wilderness, will it become harder to find? This large fleet of canoes, only part of which can be seen in the photograph, suggests how heavy use has become in a few places.

[1] *For similar ideas and a call for research to identify the critical levels of wilderness resource use, see Fisher, 1960.*

Note: The author is a geographer, Lake States Forest Experiment Station. The Station is maintained at St. Paul, Minn., by the Forest Service, U.S. Department of Agriculture, in cooperation with the University of Minnesota. *The author gratefully acknowledges the guidance and stimulation of Dr. John R. Borchert, University of Minnesota, and Dr. Gilbert F. White, University of Chicago.*

briefly. Undesirable ecological changes — wear and tear of soil and vegetation — were not studied except for some limited information on how visitors rated physical wear.[2] The main emphasis is on visitors' perception of the recreational resources of the Quetico-Superior. Data are presented on the importance of the wilderness and other qualities to various user groups, the area considered wilderness, and the characteristics of the wilderness.

Different types of visitors varied in their views of all three of these points. Canoeists were attracted to the area mainly by its wilderness qualities; other types of recreationists saw fishing or scenery as primary. The canoeists saw the wilderness as much smaller than all other visitors. Canoeists considered the wilderness overcrowded at much lower levels of use than others and objected strongly to motor boats. Logging was seldom noticed by any class of visitors, and many did not object to it when they did discover it.

Second, a method for estimating the wilderness capacity of the Quetico-Superior is suggested. This is based directly on the data dealing with the characteristics of the wilderness — especially what people think about the amount and kind of use they encounter — and only indirectly on physical environmental change. Using this method, the capacity of the Quetico-Superior for high-quality wilderness recreation is estimated. Total use seems to be fairly close to capacity, but removing motorboats from the interior would increase capacity substantially. Then, areas of over- and underuse are mapped, drawing on use distributions in the previous paper, "The Recreational Use of the Quetico-Superior Area" (Lucas, 1964a). Underused areas are larger than those overused. Use trends are reviewed, and it is concluded that capacity may be reached or exceeded soon.

Third, management implications of the findings are discussed. The focus is on possible means of better achieving the official goal of a wilderness canoe country. Separating incompatible boating and canoeing seems most important, and zoning seems to be the most useful and feasible approach to separation. Dispersing canoeists is also probably desirable, and a better flow of information may help spread out users. Eventually, however, a choice must be made between limiting numbers of visitors or losing the wilderness environment, at least as it is now defined by visitors.

THE STUDY AREA

The Quetico-Superior Area straddles the border between the United States and Canada (fig. 2). The emphasis in this study, however, is on the part in Minnesota, the Boundary Waters Canoe Area of the Superior National Forest. Capacity is a more immediate problem there than in Quetico, because use is heavier and use conflicts are greater.

The setting, both the internal conditions and the location relative to population and to other recreational areas, was discussed in some detail in the previous paper (Lucas, 1964a) and will not be repeated here.

The management goals and policies may be briefly restated. On both sides of the border the main objective is to provide a wilderness lakeland setting for recreation, without completely eliminating timber harvesting. For the Superior, the recreation is further specified to be wilderness canoeing. The regulations designed to achieve these goals are as follows (for a short history of these regulations, see Lucas, 1964b; Wildland Res. Center, 1962):

1. Roads are prohibited, except temporary timber harvest roads closed to public travel.

2. Air travel below 4,000 feet above sea level is illegal, except for flights to peripheral points of entry to Quetico Park, and administrative flights (particularly fire patrol) in both countries.

3. Motor boats are "prohibited except where the employment of such facilities by the public has been well established" in the Boundary Waters Canoe Area. There has been no announcement as to areas closed to boats, however. Quetico Park has no motorboating regulations.

[2] *A later cooperative study with the School of Forestry, University of Minnesota, is concentrating on the question of physical change induced by use of canoe campsites.*

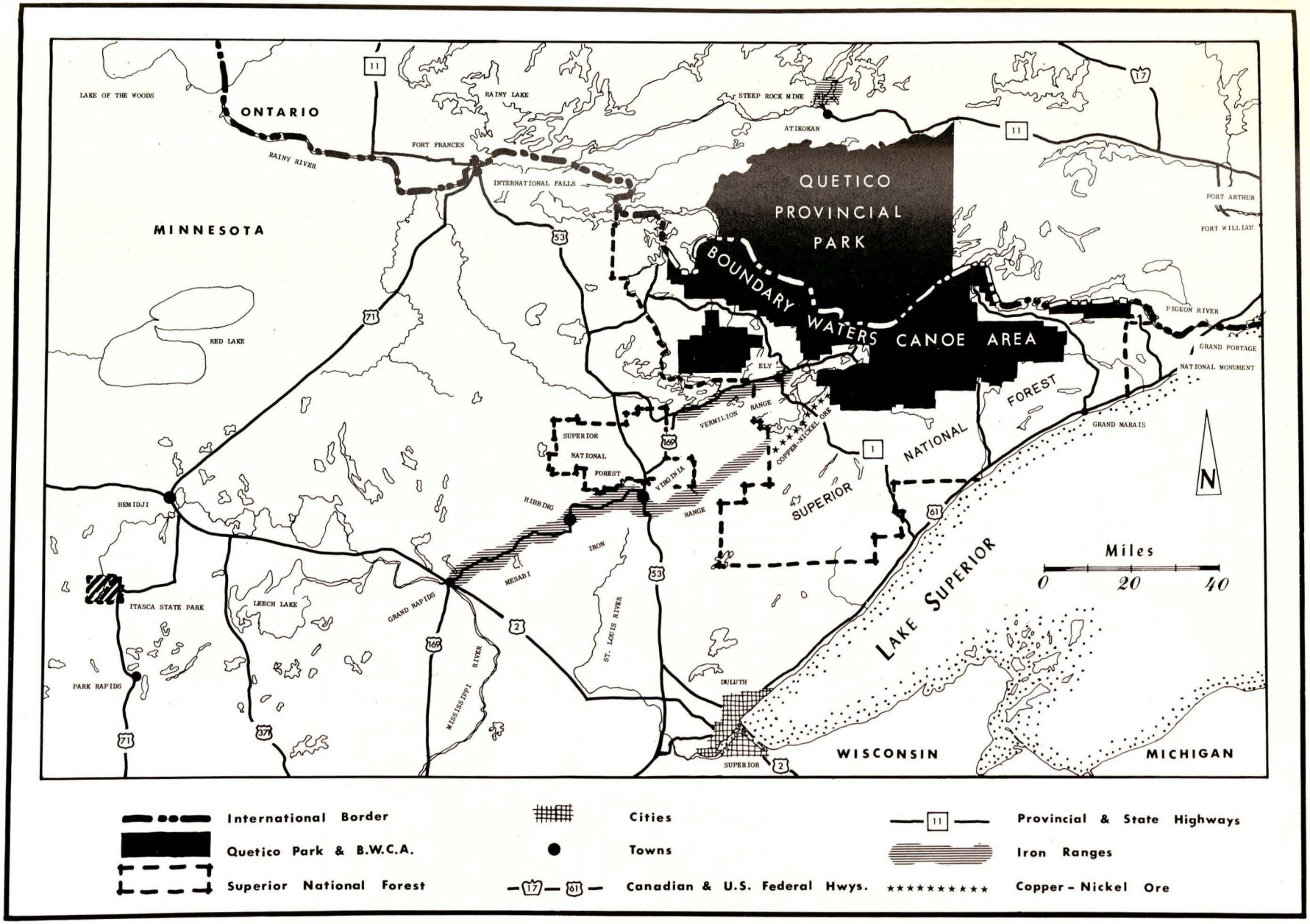

FIGURE 2. — The regional setting.

4. Storing boats or canoes on public land between periods of use is not allowed in Quetico Park. Leaving unattended equipment on National Forest land is generally prohibited, and enforcement on the Superior is planned in 1965.

5. No resorts or summer homes can be built on government land. This restriction also applies to a one-mile-wide buffer zone around Quetico Park.

6. Logging of shoreline stands or near portages is not permitted. One-third of the Boundary Waters Canoe Area is entirely closed to logging. (See Lucas, 1963, for a fuller description of this policy.)

7. Mining is generally excluded except for possible national emergencies, although because of outstanding mineral rights on some property the control is not complete in either country.

8. Dam construction is prohibited in almost all of the Boundary Waters Canoe Area. There appears to be no written policy in Quetico, although the International Joint Commission, half of whose members are Canadian citizens, ruled unanimously against dams on the Quetico-Superior border waters in 1934.

9. Quetico Park is a game preserve (except for a few Indian trap lines). Most of the Boundary Waters is open to hunters and trappers.

10. There are no special regulations on fishing.

11. Developments, such as canoe campsites and portages are simple. Most campsites have been developed by campers, some originally by Indians or Voyageurs. A few sites in Minnesota have had simple latrines, garbage pits, fire grates, and occasionally tables added by the Forest Service.

12. Private land in the Boundary Waters Canoe Area is being purchased or acquired through exchange by the Federal Government. To help recreate wilderness conditions, the Forest Service removes buildings and other improvements. This acquisition program is nearing completion. There is no private land in Quetico Park.

These policies have evolved, usually out of controversy, over a 40-year period. Both halves of the Quetico-Superior were established by governmental action in 1909 from remote lands, generally not claimed for other uses. The early plans for conventional road development in Minnesota were debated and rejected in the late 1920's. Proposed water impoundments were rejected in the early 1930's. Shoreline timber was reserved on the Superior in 1930, and in Quetico in the 1940's. The large land acquisition program in the Boundary Waters Canoe Area began in 1948 and was expanded later. Policy statements limiting use of motorboats in the Boundary Waters Canoe Area also date back to 1948. Private air travel was terminated in the early 1950's. Storage of boats and canoes will end in the 1960's.

The Quetico-Superior, generally thought of as a wilderness, is really a semi-wilderness. It is the only established National Forest area where timber harvesting and wilderness recreation are combined.[3]. Algonquin and Superior Provincial Parks in Ontario have similar policies. The rarity of this type of refuge from mechanized, commercial recreation is somewhat surprising. There have been many appeals for such recreational areas as a necessary element in the range from strict wilderness to mass recreation developments (Outdoor Recreation Resources Rev. Comn., 1962, p. 71; Wildland Res. Center, 1962, p. 11, 303; Carhart, 1961.) The founder of the Wilderness Society, Robert Marshall (1933, pp. 473-476), called for semi-wilderness in addition to primeval areas. Perhaps compromises lack the emotional appeal of more extreme positions. As a potential model for similar future areas, the Quetico-Superior seems even more important for study. Establishing more semi-wilderness areas may be one way of meeting the expected rise in visits to wilderness-type areas.

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[3] *High mountain areas in the National Forests of the Pacific Northwest are managed in a way which has some aspects of semi-wilderness. Recreation is the first priority use and other uses are carefully controlled. However, some of the land will be developed for conventional auto recreation and only part for primitive, back country recreation. (See U.S. Forest Serv., Region 6, 1962.)*

RECREATIONAL USE

The recreational use of the area was described in a previous study (Lucas, 1964a); but a brief review here will provide the reader with the background needed to better understand the capacity problem.

An estimated 132,000 people visited the study area from June 11 through September 9, 1961; 76,000 visited the Boundary Waters Canoe Area and/or Quetico Provincial Park. Canoeists outnumbered any other single type of users, and are increasing faster than other user types.

Every type of use was very unevenly distributed geographically. A few places were crowded; more were seldom visited.

Paddling canoeists covered almost all of the area, but over half entered at Moose Lake (see fig. 3 for locations mentioned in the text). The popularity of Moose Lake seemed related mainly to its good access to Quetico Park. Use at other access points also was greater at places close to Quetico Park and to Canada, at large lakes, and at places with outfitters. A portage between parking area and the water, increasing miles of gravel road, and greater distance from Duluth did not seem to reduce use. Use declined slowly along the canoe routes; half the groups penetrated at least as far as the fifth lake.

Motor canoeists were also centered on Moose Lake, but less intensely. They visited less of the area. The same factors as for paddling canoeists were related to use, but motor canoeists tended to make fewer portages than did paddlers; half the groups penetrated to the fourth lake.

Other types of visitors concentrated on the large lakes reached by roads or mechanized portages, and left most of the area unused. Auto campground use was not strongly related to site qualities; only availability of drinking water or location on large lakes seemed to be associated with heavier use. Visits by all types primarily using boats, other than auto campers, were positively related to large lakes, major water routes, access to Canada and Quetico, and, for boat campers, to direct access by car and boat trailer to the water. Boat use away from access lakes declined much more rapidly than canoe use; only one-fifth of the boating parties portaged to the second lake except where mechanical aids were available. Reasons for the choice of routes by boaters seemed vague or even random.

FACTORS LIMITING CAPACITY

The capacity of a recreational area is its ability to provide satisfaction — this is the service being produced, and this service must be described both in quantity and quality terms. Two types of factors set limits to numbers of people and their satisfaction: (1) Physical factors, and (2) the attitudes of people. Both types of factors are related to the resource base and to its use and management.

Physical Factors

Some physical elements limit numbers of people, although satisfaction may decline before the full physical capacity is reached.

Fringe access points and campgrounds in the study area (outside the Boundary Waters Canoe Area) had limited capacity, but visitors and the Forest Service tolerated overcrowding on peak holiday weekends — for example, the Lake Jeanette Campground was filled to well over three times its capacity on July 4, 1960. Normal capacity of all access parking areas in 1961 was estimated at about 1,000 cars. There were 154 campsites in 14 campgrounds within the Minnesota portion of the study area, plus the adjacent South Kawishiwi River Campground (fig. 3). This would enable over 600 people to camp on developed family units at one time, if groups averaged 4 members. There was also camping between sites at peak times. Only 17 percent of the auto-camper sample complained of crowding in campgrounds, however.

Resorts and cabins had the most definitely limited capacity of all. Fifty-nine resorts at access points had an estimated capacity of about 2,000 people at one time — over three times the campground capacity. Private cabins around the fringe

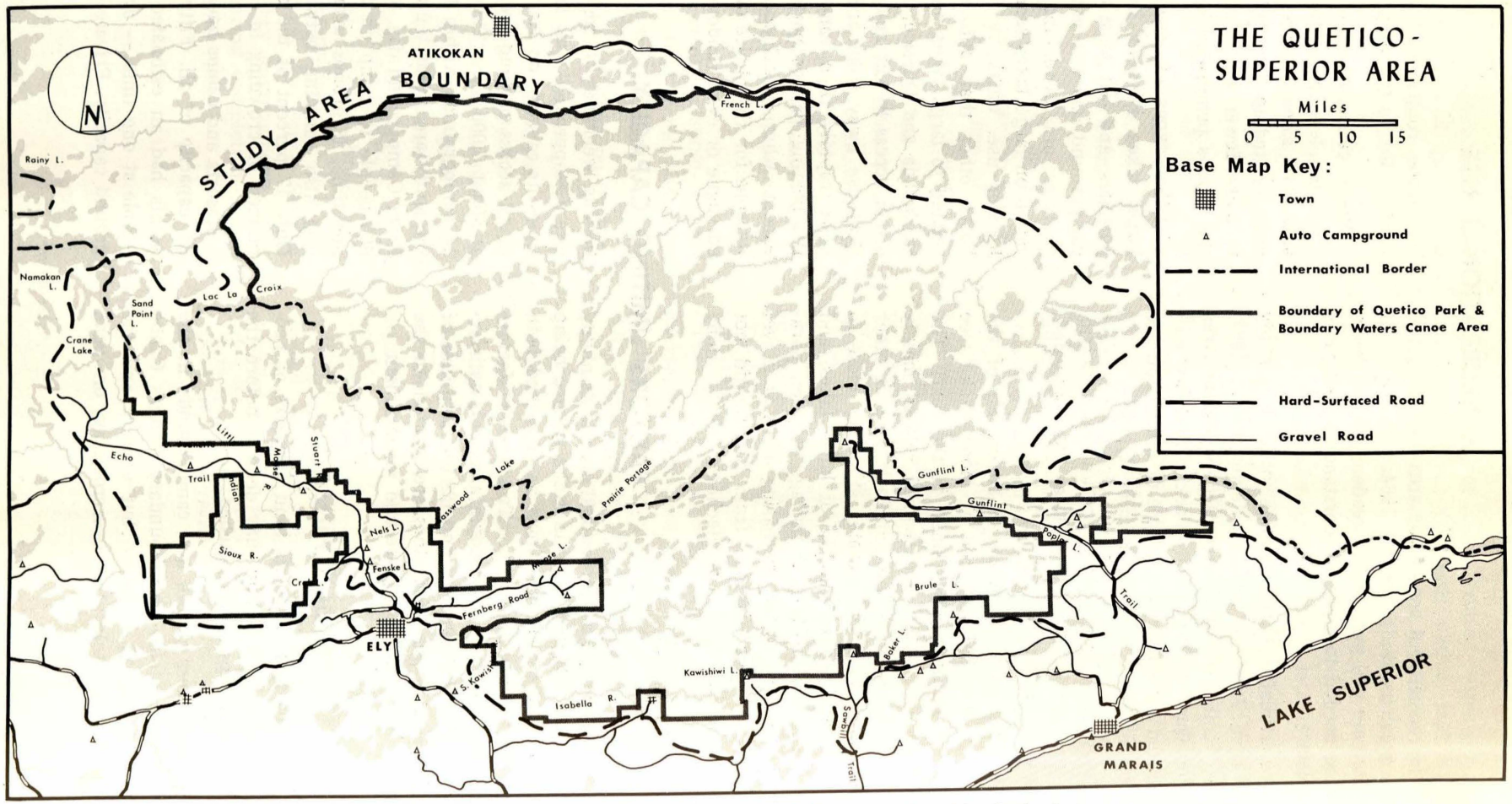

FIGURE 3. — The study area and places mentioned in the text.

totaled some 340 or roughly 1,400 persons, assuming groups of four.

The only auto access point to Quetico Park in 1961 was French Lake, in the northeastern corner of the Park. It had a large parking lot and campground (110 campsites), and resorts were nearby.

Capacity inside the canoe country is limited by similar physical factors. Canoe route campsites (also used by motorboat campers on the more accessible fringes) were difficult to enumerate. About 300 were maintained in the Boundary Waters Canoe Area by the Forest Service in 1961. In addition, a thousand or more campsites have been cleared by canoeists. Together, these sites may have as much as 10 times the campground capacity. Camping away from a previously used site was difficult in the rocky, swampy, brushy country; and potential sites, needing only some brush removal, were not very abundant, so that this was a rather effective physical limit. However, the number seemed fairly adequate; 90 percent of the sample boat campers and 75 percent of the canoeists reported no difficulty finding unoccupied sites.[4]

Two additional physical aspects of these isolated campsites set upper limits. Firewood was one. Especially on small island sites (which seemed to be almost everyone's first choice) wood supply was limited, and overcutting could spoil the appearance of such spots quickly. Sanitation was the second problem. Garbage and human wastes accumulate, and removal from such widely spread, poorly accessible places is expensive and difficult. In addition, vegetation loss due to recreational use is often large due to the generally shallow soils and the fragility of much of the ground cover, especially the mosses and lichens. Vegetation changes set a less definite physical limit, but probably reduce the visitors' satisfaction.

Within the Boundary Waters Canoe Area, 13 resorts could accommodate between 300 and 400 people in 1961, less than one-fifth the capacity of the fringe resorts. The 57 private cabins inside the Boundary Waters Canoe Area in 1961 could accommodate about 250 people, again small compared to the capacity of the peripheral cabins. Some of these have been removed since 1961, and all of the remainder will soon be gone.

These physical limits are real, although most are not yet seriously pressing. If it were considered desirable and necessary to raise any of these physical ceilings, however, it usually would be comparatively easy if the money were available. For example, in three seasons the capacity of National Forest campgrounds was doubled over the total that had been developed during the preceding 30 years.

User Attitudes

Important limitations on capacity are set by visitors' attitudes towards the area and its management and use. These limitations are difficult to overcome, partly because different groups hold incompatible views and partly because we know little about how these attitudes form or how they can be changed.

Attractions of the Area

Basic to capacity limits based on attitudes is knowledge of what qualities of the Quetico-Superior area attracted people in the first place. A visit to the Canoe Country was the primary purpose of almost all trips; very few people stopped as part of a longer trip, as would be common at Grand Canyon, for example (table 1). Many of these people had very vague ideas as to just where the Boundary Waters Canoe Area was, and some

TABLE 1. — *Number and percent of parties stating that a visit to the Boundary Waters Canoe Area was the primary purpose of their trip*

Type of recreationist	Number of sample groups	B.W.C.A. visit the primary purpose	
		Number	Percent
Canoeists	85	84	99
Day-users	9	9	100
Auto campers	96	86	90
Boat campers	24	23	96
Resort guests	57	57	100
Private cabin users	21	21	100
Total	292	280	96

[4] *A sample of each visitor type was chosen randomly over the entire study area during the summers of 1960 and 1961. In total, 292 groups were interviewed. Details of the sample selection and copies of the questionnaire forms are available in mimeographed form upon request to the Station.*

thought they had been in it when they had not. Many people probably interpreted the name as a general descriptive phrase, similar to "border lakes," instead of an official title for a specific area.

The people who considered a visit to the Canoe Country as their primary purpose were then asked what characteristics of the area, if any, caused them to choose it rather than some other vacation region in the United States or Canada. Some people, who apparently did not consider the area to be different (col. 3, table 2), replied that, "I live near here," "I have friends or relatives here," or gave the tautological answer, "I like it." These responses were most rare among canoeists and people in the auto campgrounds. They were most common among private cabin visitors, for whom the location of the cabin, once built, eliminated any further choice of area. Such answers were also common for people using the area only for the day, mostly local folk.

Answers classified as wilderness qualities (col. 4, table 2) included: "wild, uncivilized, primitive, uncommercialized, remote, uncrowded, quiet, peaceful, no outboard motors." It is recognized that these terms may have held different meanings for different groups, and also that some people interviewed may have thought of fishing or scenery as wilderness qualities. The table does suggest the relative importance of wilderness as an attraction, however. It was of major importance for canoeists (especially paddlers) and was important for roadside campers, but it was secondary for all other visitor types. Only canoeists mentioned wilderness in more than half of the interviews.

This evaluation of wilderness attractions seems to be of the same general magnitude as that reported by Taves, Hathaway, and Bultena (1960, pp. 12-13), who asked what differences people felt set the Quetico-Superior apart (these are only differences, not necessarily attractions). Roughly comparable wilderness qualities were mentioned by 58 percent of their respondents.

The user classes did not differ significantly in the frequency with which they mentioned fishing as an attraction unless the two classes of canoeists, who were at the opposite ends of the scale, are considered separately. Motor canoeists mentioned

TABLE 2. — *Percent of parties citing certain qualities as a basis for choice of the area (summer, 1960 & 1961)*

Type of recreationist	Number of sample groups	Attractive qualities cited, percent of groups[1]				
		None, vague, tautological	Wilderness	Fishing	Scenery	Facilities
Canoeists	84	6*	71*	29	28	6
Paddlers	63	6	75	16**	29	8
Motorized	21	5	62	67**	24	0
Day-users	9	33*	33*	33	11	0
Auto campers	86	8*	49*	29	30	13
Boat campers	23	17*	35*	48	26	13
Resort guests	57	12*	39*	42	42	9
Private cabin users	21	38*	10*	14	33	0
Total	280	12	49	33	32	9

[1] *All responses, sometimes three or four per party, were tabulated and therefore totals exceed 100 percent.*

* *The six major types of recreationists (ignoring the subdivision of canoeists) differed significantly in the frequency of mention of two attributes (none, vague, etc., and wilderness) at the 0.005 level when tested by chi-square. In other words, there was only one chance in 200 of such large differences occurring just by chance in a sample of this size. The six major types did not differ significantly for other qualities.*

** *The two types of canoeists differed in the frequency of mention of fishing as an attraction at the 0.001 level.*

fishing more often than any other visitor type, and were the only ones to cite fishing over half the time. In contrast, only about one-sixth of the paddlers mentioned fishing. The motor canoeists also complained most about poor fishing on a free-response question about disappointments (26 percent, compared to 3 percent of the paddlers and 20 percent of the motorboaters). These two types of canoeists differ in many ways, despite seeming similarities which have led previous researchers to place them in one class. Apparently the paddlers see the Quetico-Superior as a place for wilderness travel and camping, and the motor canoeists see it as a place for wilderness fishing.

Scenery was fairly important for all types except day-users. Resort guests and auto campers mentioned scenery as often as fishing.

Facilities were minor as an attraction for every type of visitor.

The Area Considered Wilderness

The area that was viewed as wilderness also varied significantly from one type of recreationist to another.

Figures 4 through 7 show the wilderness as seen by four of the major classes of recreationists. These maps represent the responses to the question, "Where did the members of your group feel 'the wilderness' began?" This was combined with data indicating where the group had been, and produced a "vote" by each party as to whether a particular lake or section of road was or was not wilderness, in their terms. The aggregation of these votes formed the basis for the maps.

The opinions of motorized canoeists and private cabin groups were not mapped because the samples were small and unevenly distributed. In general, the motorized canoeists viewed as wilderness an area that was larger than for paddlers, but smaller than for the various other groups. These maps indicate the amount of variation in the perceived wilderness between people *within* the class. Figure 8 summarizes this series of maps and facilitates the comparison of wilderness perceptions *between* the classes by showing the boundaries of the areas considered wilderness by at least 50 percent of the groups in each type.

The paddling canoeists perceived the wilderness as smaller and more cut up than did other users. They considered the wilderness to be *smaller* than the administratively defined area. Only one area of their wilderness was outside the Boundary Waters Canoe Area; this was the area directly north of Ely.

There was so little use of the Little Indian Sioux portion of the Boundary Waters Canoe Area (northwest of Ely) that no samples were obtained.

In Canada the situation was reversed; a large area *outside* Quetico Park was considered wilderness, particularly in the east; however, new roads are penetrating this area. No data were collected for the northern part of Quetico Park.

Apparently all types of visitors other than canoeists saw a much larger wilderness than contained within the Boundary Waters Canoe Area. The differences between the various types were not significant. Auto campers, boat campers, and resort guests all had similar views of the wilderness, and many of the small differences resulted from different locations of sample groups. All of these groups used motorboats primarily, and this common factor, rather than the type of accommodations used, seems the critical variable.

Effect of Recreational Use on Wilderness Perception

The most important variable affecting wilderness perception seemed to be amount and kind of recreational use. Different categories of recreationists differed sharply in their attitudes towards these two aspects of use. The major differences divided along the same lines as the areal concept of wilderness. The canoeists wanted much lower levels of use and distinguished more sharply between sorts of groups met than did motorboaters. A lesser difference existed between the paddling and motor canoeists.

Visitors were first asked, "What (if anything) about the area bothered or disappointed members of your group?" The interviewer did not suggest answers. Canoe-trippers and auto campers mentioned crowding most often (table 3). Most of the complaining auto campers were canoeing, usually paddling; the type of craft used seemed to condition strongly the perception of crowding, as the second part of table 3 shows.

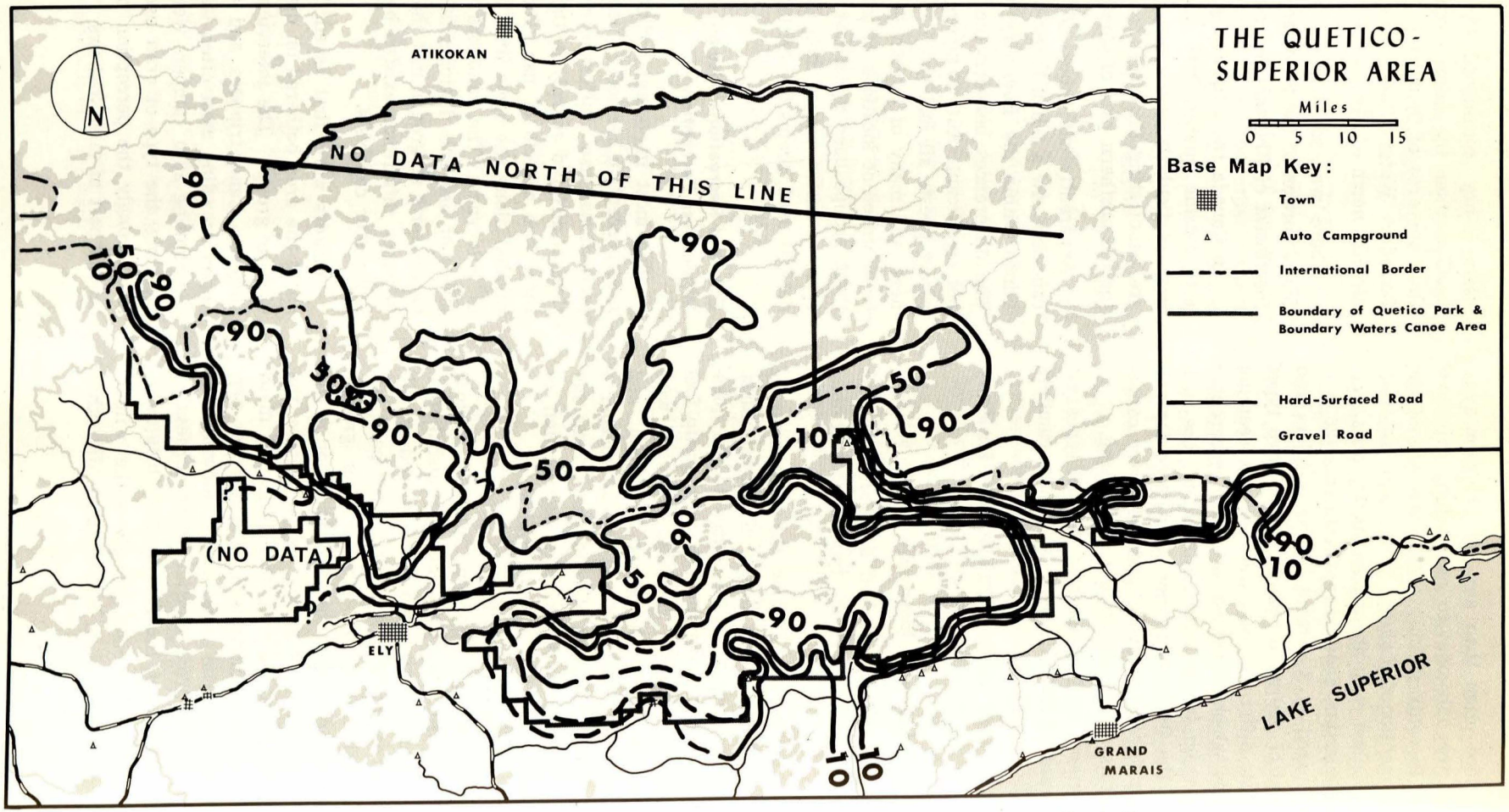

FIGURE 4. — The area considered "wilderness" by the paddling canoeists. The isoline values are the percentage of parties visiting each area which described that area as being "in the wilderness." The broken portions of the isolines indicate that data were lacking and subjective estimates were made. The map is based on 1960 data.

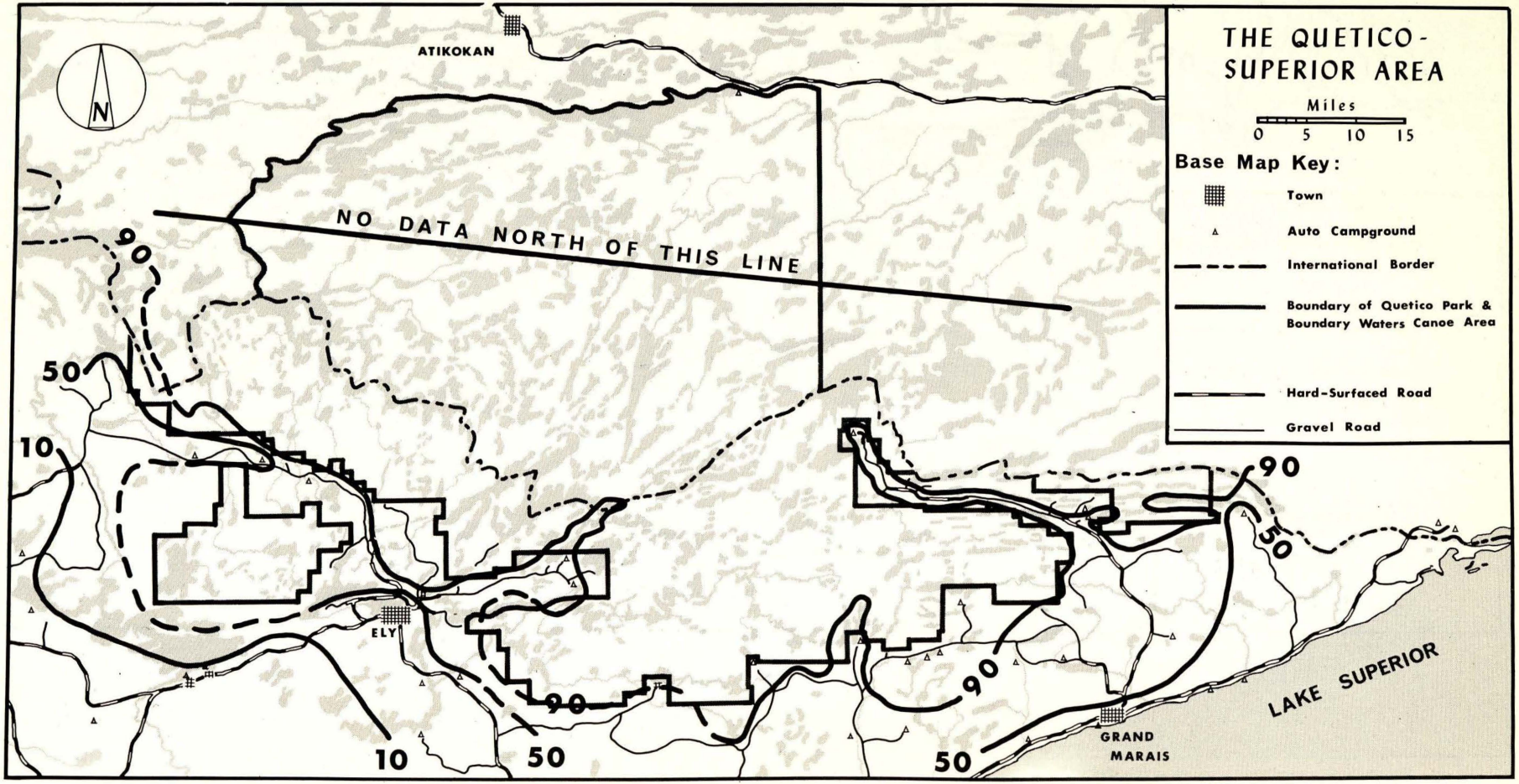

FIGURE 5. — The area considered "wilderness" by the auto campers. Definitions are the same as in figure 4.

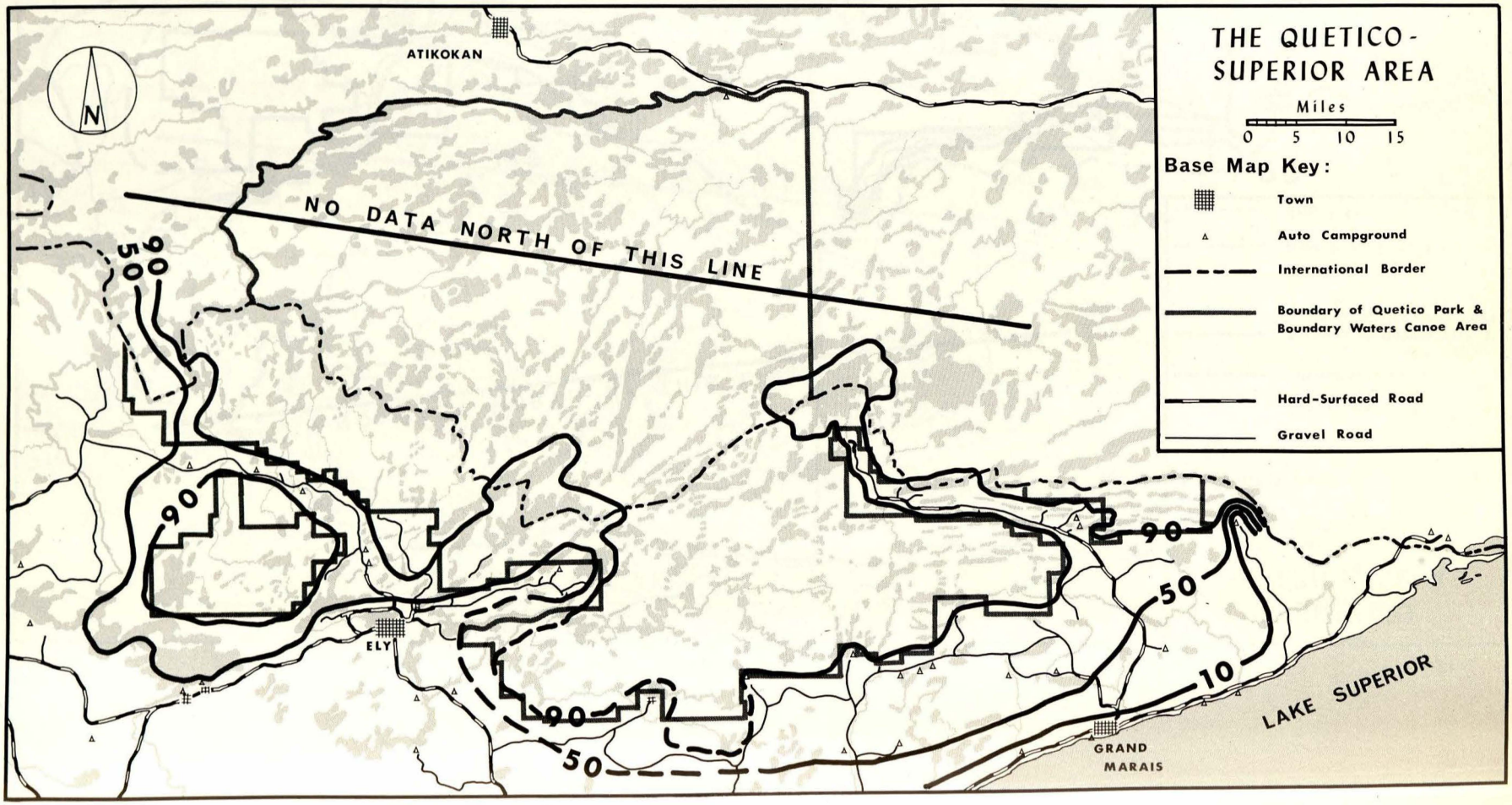

FIGURE 6. — The area considered "wilderness" by the boat campers. Definitions are the same as in figure 4. The map is based primarily on 1960 data, with some 1961 information.

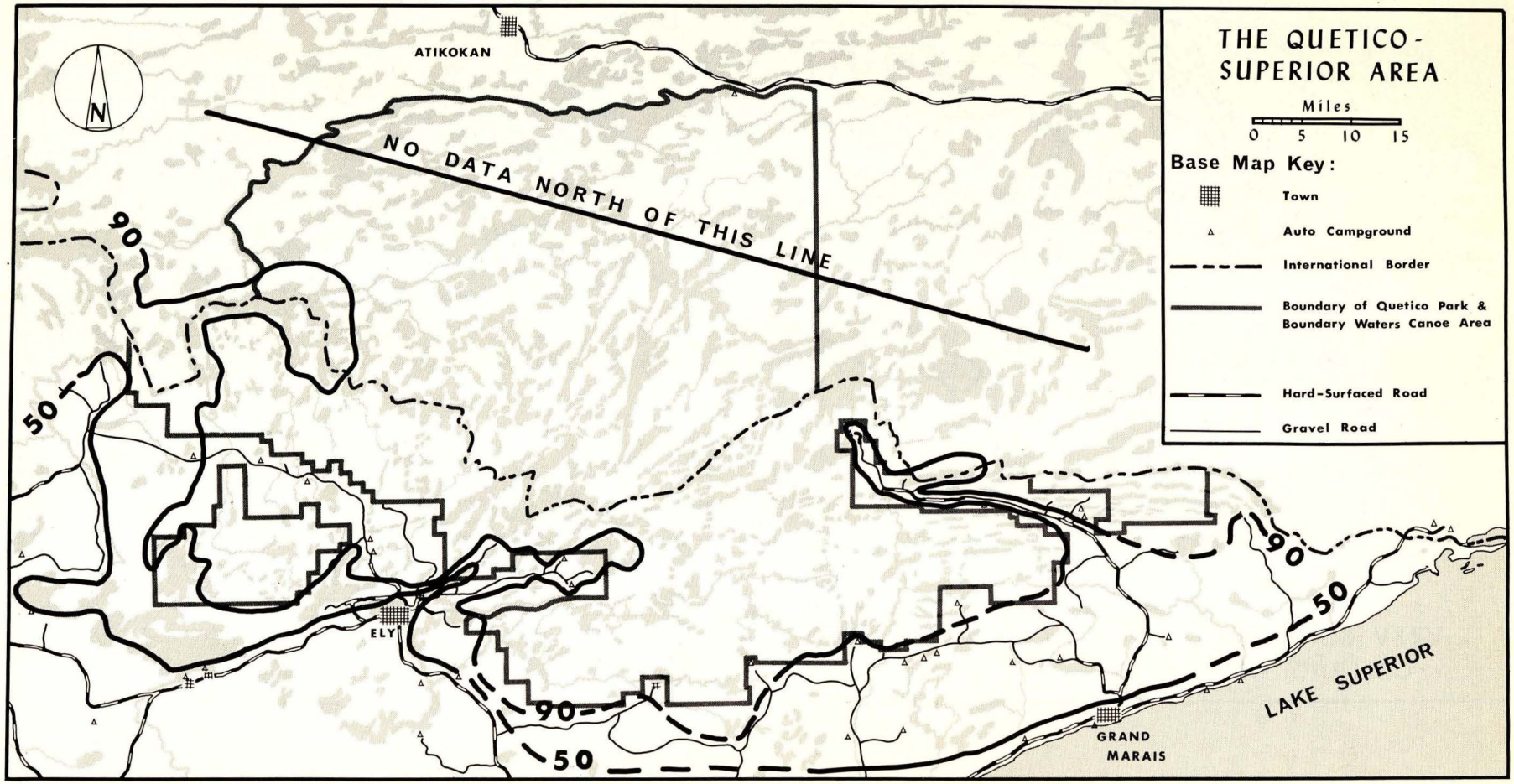

FIGURE 7. — The area considered "wilderness" by the resort guests. Definitions are the same as in figure 4. The map is based primarily on 1960 data, with some 1961 information.

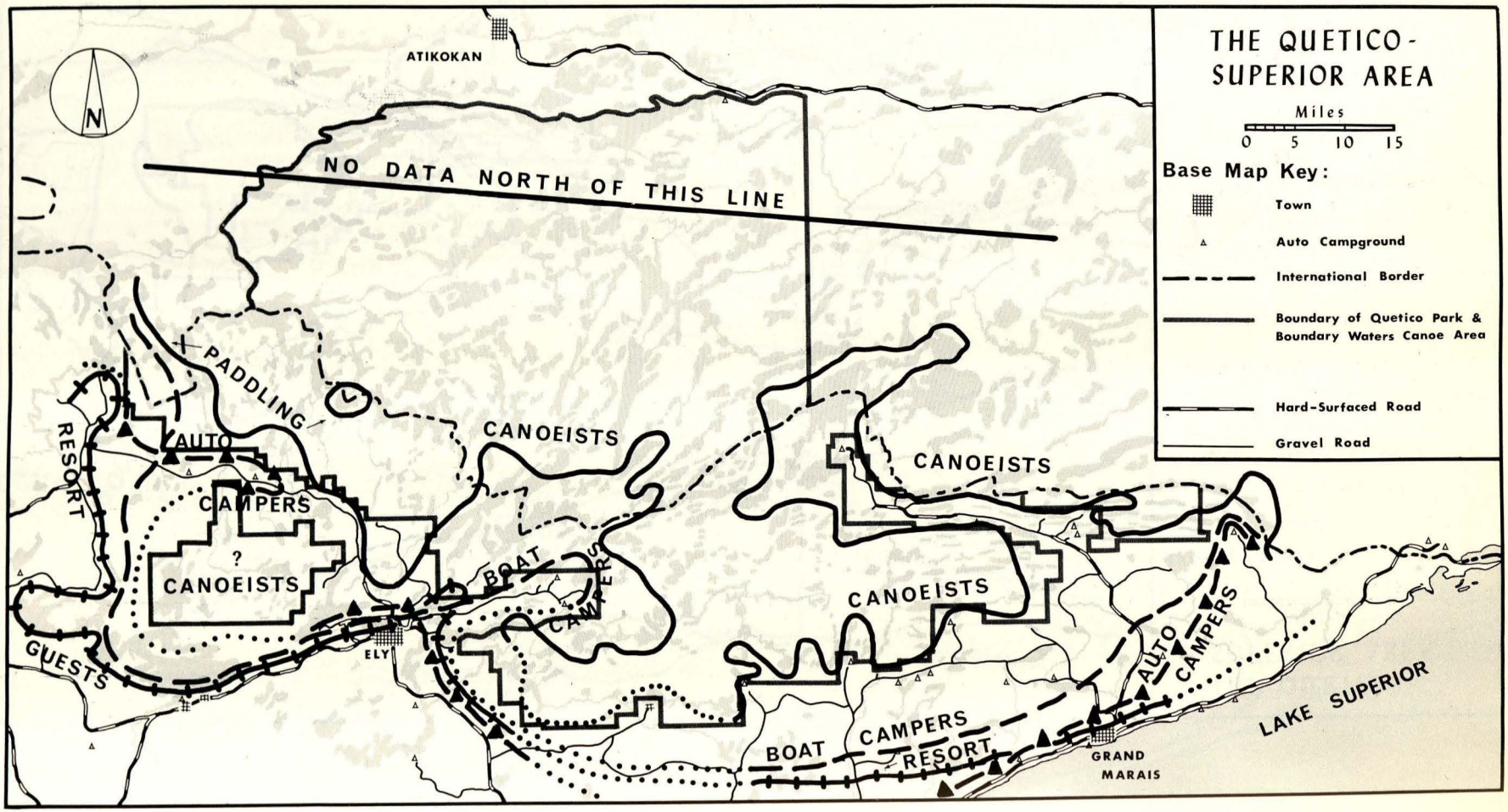

FIGURE 8. — The area considered "wilderness" by at least 50 percent of the visitors in each of the four major user types. The area in the interior, that is, away from the roads and generally to the north of the line for each user type, was rated as "wilderness" by 50 to 100 percent of the visitors of that type reaching the area. The dotted portions of the lines indicate that data were lacking and subjective estimates were made. Based on 1960 data, primarily.

TABLE 3. — *Number and percent of various categories of recreationists mentioning overcrowding as a disappointment (free-response question)*

Type of recreationist	Number of sample groups[1]	Mentioning crowding:	
		Number	Percent
Canoeists	85	9*	11
Day-users	9	0	0
Auto campers	96	10*	10
Boat campers	24	2*	8
Resort guests	57	1*	2
Private cabin users	21	0	0
Total	292	22	8
Paddled canoe	92	12**	13
Motorized canoe	38	4**	11
Motor boat	144	6**	4
No boating	27	1**	4
Total	301	23	8

[1] *A few parties used more than one type of craft, and totals in the lower half of the table therefore exceed those in the upper half.*

* *Significantly different only at the 0.25 level, tested by chi-square. The differences could occur by chance one time out of four.*

** *Significantly different at the 0.10 level, tested by chi-square. There is less than one chance in ten of the differences being the result of chance.*

Visitors were asked specifically later in the interviews, "Were members of your group bothered by crowding on any lakes in the area?" Except for canoeists, crowding was not a serious problem and differences between groups were small (table 4). But canoeists complained of crowding more than twice as often as any other group. Most dissatisfaction was expressed by paddling canoeists ending their trips at very heavily used Moose Lake; among these, 54 percent complained of overcrowding (table 5). This suggests that crowding is a local problem and that, if use increases, it may become a problem in other places.

The reaction to use intensity was approached in still another way. Groups were asked how many other groups they had met on an average day, and whether they felt these numbers were too many, about right, or too few (only one party said they met too few people). The canoeists presented a distinct pattern (fig. 9); they reacted very consistently to increasing use and in general were most sensitive to use. The erratic data for other groups suggest more heterogeneous views of crowding.[5]

Canoeists seemed to react to two critical points in use intensity. One occurred when anyone was met and complete solitude was lost. (This seemed to be the only critical point for the other user types.) The second critical point was reached when 6 to 10 groups were seen in a day; at this level a majority complained.

A smaller number of groups was informally asked, "How many canoeing and motorboating

[5] *Part of the inconsistency may be due to somewhat smaller samples for noncanoeists: A number of auto campers did not use the lakes, by mistake some resort guests and private cabin users were not questioned on this point, and a few early questionnaires did not contain the question.*

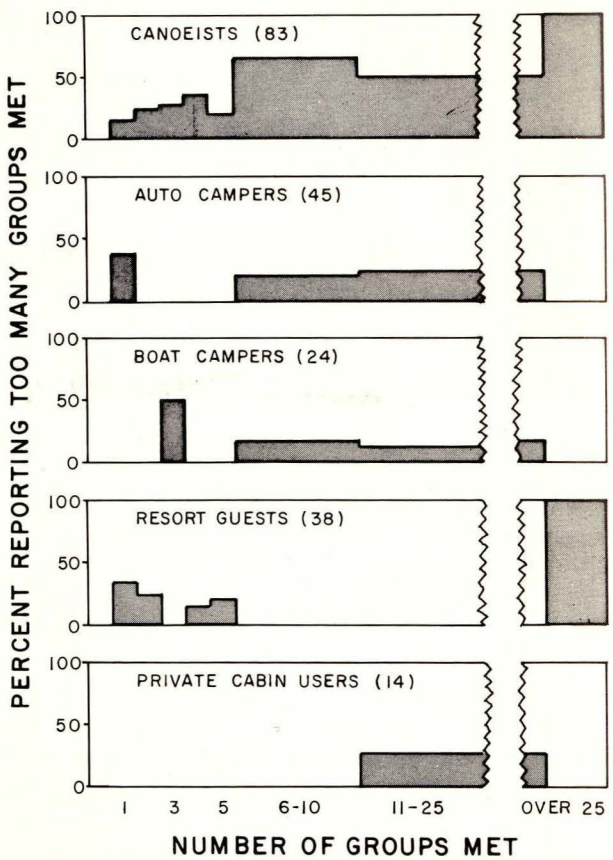

FIGURE 9. — Percentage of sample groups reporting that the number of other groups met on an average day on their visit was "too many." Number of sample groups in each visitor type is shown in parentheses.

TABLE 4. — *Opinions of crowding on lakes held by various categories of recreationists (direct question)*

Type of recreationist	Number of sample groups[1]	Percent bothered by crowding on lakes:		
		Quite a bit	A little	Not bothered
Canoeists	85	19*	18*	63*
Paddlers	64	20	20	60
Motorized	21	14	10	76
Day-users	5	0*	0*	100
Auto campers	74	7*	3*	90*
Boat campers	23	8*	8*	84*
Resort guests	57	5*	2*	93*
Private cabin users	21	5*	9*	86*
Total	265	10	9	81
Paddled canoe	92	16*	18*	66*
Motorized canoe	38	11*	5*	84*
Motor boat	144	6*	2*	92*
Total	274	10	9	81

[1] *Twenty-seven of 292 groups did not use the lakes and are excluded. Nine used more than one type of craft and are repeated in the lower half of the table.*

* *The differences between types of visitors appear highly significant. A chi-square test indicates less than one chance in one thousand of a sample of this size producing differences this large by chance.*

TABLE 5. — *Percent of recreationists interviewed at Moose Lake access points reporting opinions of crowding on lakes*

Type of recreationist	Number of sample groups	Bothered by crowding on lakes:		
		Quite a bit	A little	Not bothered
Paddled canoe	24	29	25	46
Motorized canoe	7	14	0	86
Motor boat	14	7	14	79
Total	45	20	18	62

groups could you meet in a day before you would feel there was too much use?" Canoeists usually wanted no motorboats (even those who said they "did not mind" meeting motorboats) and zero to five canoes. Motorboaters usually said "no limit" on canoeists and 25 to 100 boats. Some motorboaters seemed puzzled by the question. They apparently were not thinking in terms of seeking solitude.

The relation of amount and type of use to the feeling of being in the wilderness was studied in some detail, comparing the maps of wilderness ratings to maps of estimated use presented in a previous paper (Lucas, 1964a).

Heavily used areas were less often considered wilderness by all visitor types, especially the canoeists. Moose Lake, east of Ely, the most heavily used point, produced the following responses

	Wilderness	*Not wilderness*
Paddling canoeists ..	0	23
Motor canoeists	2	6
Boat campers	2	4
Auto campers	3	3
Resort guests	4	0
Day-users	1	0

The lakes, or sections of rivers, reached from each access point within the study area were ranked, first in order of wilderness rating and then in order of total estimated summer use. The number of groups visiting each lake was the measure of use. Each group was counted once only on each lake visited; they were not recounted if they returned over the same route. Man-days would have been a better measure, but were unavailable. The Spearman rank correlation coefficient for paddling canoeists was —0.42; the more use, the less wilderness. This means that about 18 percent of the variation in canoeists' wilderness ratings was accounted for by season-long visitor totals. For boaters (combining resort guests, auto campers, and boat campers), the rank correlation was —0.37, accounting for 14 percent of the variation. This seems fairly substantial when it is remembered that seasonal use is only an approximate index of the number of visitors observed on a particular lake by a sample party. Furthermore, 200 groups on a lake 20 miles long and full of islands would be much less conspicuous than the same number on a narrow river, but all locations were treated identically.

This relationship between use and wilderness was graphed (fig. 10). Locations were averaged by 100-group intervals up to 400 groups, then 200-group intervals to 1,000, and then 500-group classes. The canoeists' perception of wilderness was consistently lower than the boaters', and

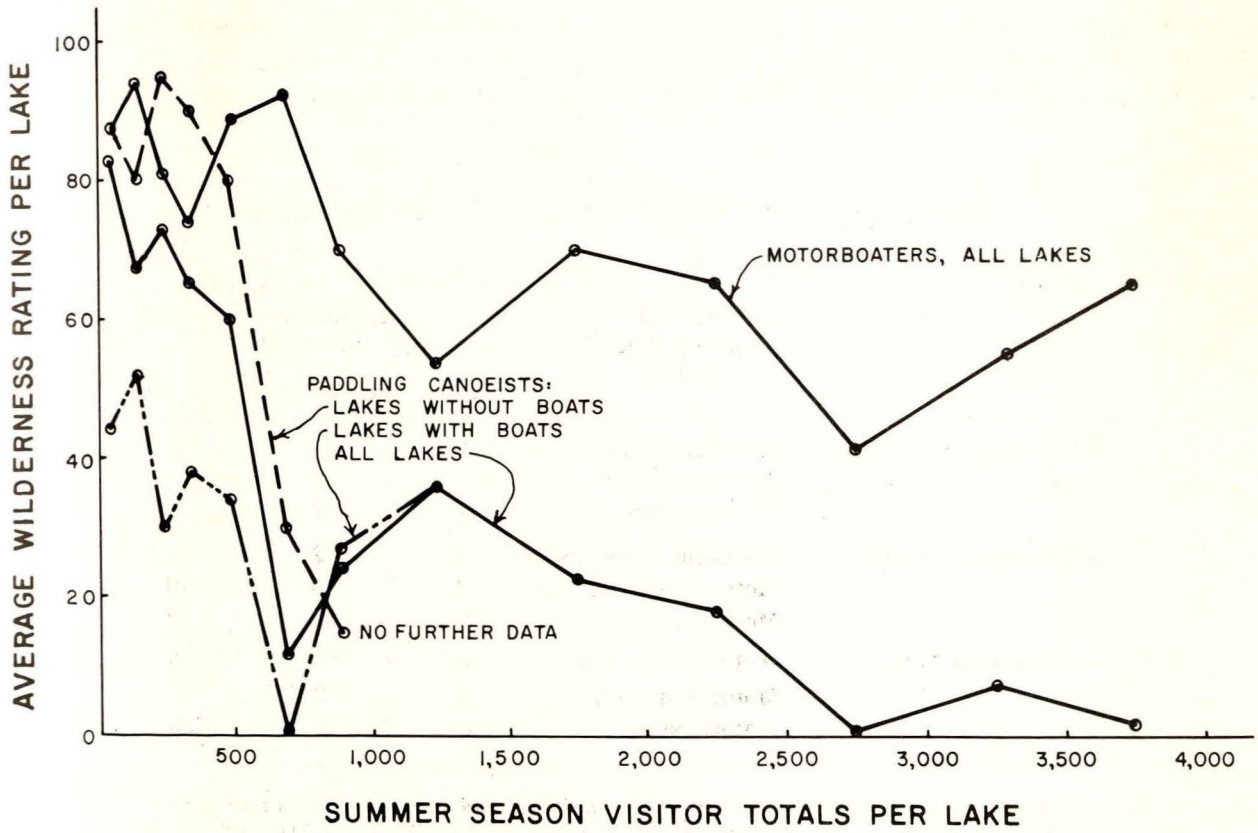

FIGURE 10. — The wilderness ratings of paddling canoeists and of motorboaters (resort guests, auto campers, and boat campers) related to amount and type of use. Each group was counted once only on each lake visited.

dropped faster as use increased. On the average, less than half of the canoeing groups considered places wilderness when group visits during the summer exceeded about 600. The line on the graph representing boaters' wilderness perception, in contrast, generally stays above 50 percent even at peak use levels.

The type of use encountered may have been even more important to paddlers than the number of groups, however. The locations used only by canoeists were separated from those used by both boaters and canoeists (fig. 10). Comparable levels of use produced higher wilderness ratings by canoeists where motorboats were absent — usually over twice as high as for places reached by boats.

The one-way resentment of boaters by canoeists was also brought out by questions on their reactions to meeting other types of groups. The paddlers distinguished sharply between all three types of transportation (table 6). They disliked meeting boats, were less resentful of motorized canoes, and apparently enjoyed meeting at least some kindred spirits paddling canoes. Motor canoeists made an equally sharp distinction between motorboats and canoes. They distinguished less between the two types of canoe parties; but still preferred meeting paddlers rather than fellow motor canoeists. Motorboaters, in contrast, were generally indifferent about whom they met. They considered motorized canoes as synonymous with motorboats, but many boaters enjoyed the local color provided by the paddlers. One can imagine people in a powerboat smiling at a group of slowly moving paddlers and being glared at in return.

One other use created even more friction — water skiing. This sport was not common in the canoe country, but there was some on a number of the directly accessible lakes and even occasionally over portages. Most people who were not water skiing wanted to see it banned in the wilderness setting (table 7). Some resort parties volunteered this as the reason they had stopped visiting resorts in Wisconsin. Auto campers were almost unanimously opposed to water skiing. Probably no single use can so drastically reduce the capacity for all other uses, and, because of the large area used by a water skier, a modest amount of skiing can have a large effect.

TABLE 6. — *Reaction of three user types to meeting other types*

Kind and number of sample groups questioned	Kind of group met on trip	Reaction of sample groups (in percent) to meeting[1]		
		Disliked	Did not mind	Enjoyed
Paddling canoists (62)	Paddling canoeists	2	26	72
	Motor canoeists	37	61	2
	Motorboaters	61	37	2
Motor canoeists (21)	Paddling canoeists	0	62	38
	Motor canoeists	0	90	10
	Motorboaters	62	38	0
Motorboaters (40)	Paddling canoeists	0	55	45
	Motor canoeists	3	72	25
	Motorboaters	3	72	25

[1] *A few groups were evenly divided in their opinions and were counted as half groups under each heading. The chi-square test indicates most of the differences are highly significant. There is far less than one chance in a thousand that the differences in either type of canoeists' reactions to different types of users resulted from chance (.001 level). In addition, motorboaters' reactions are very significantly different from canoeists, although the differences in boaters' reactions to different types are significant only at the .25 level.*

TABLE 7. — *Reaction to a ban on water skiing in some areas*

Type of recreationist	Number of sample groups	Reaction (percent)		
		Good idea	Bad idea	Don't care
Canoeists	77	77	13	10
Day-users	7	29	29	42
Auto campers	76	89	4	7
Boat campers	21	48	14	38
Resort guests	50	70	20	10
Private cabin visitors	16	63	6	31
Total	247	74	12	14

Location in Relation to Wilderness Perception

Apparently perceived wilderness need not be in Canada, nor need it involve travelling north. For example, the large block of land in the United States south of the Gunflint Trail was considered wilderness.

Remoteness or distance from access points is often thought of as a necessary feature of wilderness. The study of wilderness by the Wildland Research Center (1962, p. 119) defined wilderness recreation as use over one-half mile from a road. To test for the effect of remoteness, all of the first lakes and rivers were grouped, then the second, and so on. Surprisingly, neither graphs nor rank order correlation coefficients relating wilderness perception to use suggested that remoteness influenced ratings. Where use was comparable, lakes close to starting points were classed as wild as often as more remote places, except to some extent for organized youth groups such as Boy Scouts.

Development in Relation to Wilderness Perception

The paddlers' wilderness almost never contained roads (fig. 4) or buildings. The main exception for roads was a 10-mile stretch of the Echo Trail north of Ely. Almost half of the sample paddling groups classed this as wilderness. The road is narrow, winding, and hilly, but partly black-topped. The Echo Trail west of this section is all gravel, but is newer, fairly wide, and level, with gentle curves; no canoeists considered the area wild. In contrast, a majority of motorboaters of all types felt that the wilderness began after the last town. Road construction standards did not seem related to boaters' wilderness perception, as mapped (figs. 5 to 7), although some did mention the "end of the black-top" as the entrance to their wilderness.

Attitudes towards roads are particularly interesting as an example of opposition to what would be considered improvements almost anywhere else. This "Through the Looking Glass" reversal is particularly important in and near wild areas.

All of the access roads had narrow gravel sections where 30 miles an hour was an excessive speed. At some level of traffic, dust and driving hazards set a limit (to numbers of people and satisfaction) that can be raised only by rebuilding the roads. This is a dilemma, however, because over half of the people considered high-standard roads out of place (fig. 11). The sample groups were asked, "Do you feel that straightening and blacktopping more roads is a good idea, a bad idea, or something you don't care about either way?" The replies were:

	Number	Percent
Good idea	94	38
Bad idea	133	54
Don't care	15	6
Group divided	5	2
Total	247	100

The difference between groups that expressed an opinion was significant at the 0.10 level, tested by chi-square.

All types of recreationists were divided on this question, but a majority of canoeists, campground campers, and resort guests opposed more road "improvements," and only boat campers and private cabin visitors had a majority for "better" roads. Discussion with visitors suggested that blacktopping was less objectionable than straightening and widening.

Other facilities in the auto-accessible fringe (outside the established wilderness boundaries, but still in the wilderness for many people) were sometimes unwelcome.

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FIGURE 11. — Are roads like this appropriate as wilderness approaches? Of the visitors sampled, 54 percent said, "No;" 38 percent said, "Yes." The objections were not limited to any one type of visitor.

Most groups favored more small auto campgrounds; 95 percent of the auto campers did, and so did most boat campers and private cabin users. Resort guests were usually indifferent, but more favored than opposed additional small campgrounds. Canoeists, who seldom used campgrounds, were almost evenly divided — one-third in favor, one-third against, and one-third indifferent.

Building large campgrounds, however, was definitely a bad idea in everyone's opinion — only 12 percent of all groups and only 14 percent of the car camper groups approved. How these people defined large and small campgrounds is not known, but they seemed to feel the Superior National Forest campgrounds were small. The average for these was about 10 family units, and the largest provided for 40 groups. Many volunteered their dislike for the crowding found in large State Parks. On a free-response question, 15 percent of the auto campers listed uncrowded conditions or campsite privacy as the thing about the area which pleased them particularly, making privacy a close third behind good facilities and scenery.

Eighty percent of the visitors to campgrounds approved of installing wells or taps where these did not exist, and only 7 percent objected. Water supplies were also considered an improvement or insignificant by other groups (except canoeists, who again were almost evenly split three ways — for, against, and indifferent).

Launching ramps for boat trailers, a key factor because of their direct relation to the use of large, powerful boats, were controversial. Canoeists strongly opposed additional ramps, most boat campers and day-users favored more, and other groups were quite divided (table 8). An appreciable number in every class opposed more ramps — even those people who used motors. Some of these parties used small boats and motors, which did not require ramps, and they disliked the powerful boats almost as much as did the canoeists.

Within the areas accessible only by water, different facilities are of interest. Canoe campsites, as we have said, were fairly adequate in number. An open question on desired changes produced re-

TABLE 8. — *Reaction to the construction of more launching ramps*

Type of recreationist	Number of sample groups	Reaction (percent)		
		Good idea	Bad idea	Don't care
Canoeists	77	10	74	16
Day-users	7	57	29	14
Auto campers	76	49	39	12
Boat campers	21	60	21	19
Resort guests	50	46	32	22
Private cabin visitors	16	37.5	37.5	25
Total	247	37	47	16

quests for more campsites from only about 1 percent of the sample. People who used these sites were satisfied with and in many cases preferred very simple facilities. Canoeists more often asked that the picnic tables on back-country sites be removed than that more be added. More tables were wanted by 17 percent of the boat campers, however. None wanted water supplies other than the lakes.

Portages were the other main facility. On the free-response question about desired changes, 11 percent of the canoeists and 1 percent of the auto campers asked for better portage marking. (Many portages in the Boundary Waters Canoe Area have a small Forest Service sign giving the names of the lakes and the distance, but most of those in Quetico Park have only blazed trees.) Only 1 percent of the canoeists and resort guests and 4 percent of the boat campers called for other portage improvements. Later, when asked directly about portage quality, a majority of all types of visitors said they liked the portages as they were. More than three-fourths of both canoeists and other visitors said the portages in the United States should be left about the same; 3 percent of the canoeists and 6 percent of the others said the portages had already been over-improved. The remainder, less than one-fifth, wanted some improvements. The rougher Canadian portages were not quite as popular, but 62 percent of both types of visitors said they should be left as they were. Less than a third wanted improvements in Canada.

Nonrecreational Use in Relation to Wilderness Perception

Another set of attitudes centered on nonrecreational uses of the area. Logging, especially, has been vehemently objected to for western wilderness areas, as well as in the Boundary Waters Canoe Area. But the problem appears to be overrated in the Canoe Area, at least as far as the visitors are concerned (Lucas, 1963). First, there was little awareness that timber cutting was carried on in the area. Of the sample visitor groups, 42 percent said they did not know if logging was allowed in the Boundary Waters Canoe Area; 28 percent said logging was prohibited; and only 30 percent gave the correct answer. Of the visitors in the general vicinity of logging operations, 51 percent gave the correct answer. Still fewer noticed logging or recognized it when they saw it. Only 18 percent of all visitors thought they had observed logging in the study area. Near cutting areas, 46 percent reported observations (table 9). Canoeists, who covered more of the area than other groups, reported proportionately fewer observations than the predominantly boating types.

TABLE 9. — *Visitors' reactions to logging*

Area and type of recreationist	Number of sample groups	Percent of groups who—		
		Did not notice	Noticed, no objection	Noticed, objection
Areas remote from logging				
Boaters[1]	138	84	12	4
Canoeists	69	94	3	3
Total[2]	207	87	9	4
Areas near logging				
Boaters[1]	31	48	39	13
Canoeists	9	75	12.5	12.5
Total[2]	39	54	33	13
Total, for all areas:	246	82	13	5

[1] *"Boaters" refers to the total for all noncanoeist user types.*

[2] *Total numbers reporting noticing logging in the areas near cutting differ significantly from the areas distant from logging at the 0.001 level, tested by chi-square.*

Probably fewer visitors observed logging in the Boundary Waters Canoe Area itself because the question included some of the surrounding area. Many observations may have been reported because logging trucks were encountered, or piled pulpwood was seen on access roads.

Further, even when logging was observed — or when people thought they had observed it — they often did not object to it. About 30 percent of those who said they had observed logging were bothered by it. In the areas near logging this was

only 13 percent of all visitor groups. The canoeists, who in most other respects were also the most sensitive class, objected most often to logging when it was observed (half of the cases), but this was only 4 percent of the total interviews (13 percent in areas near logging) because of their very low rate of observation. In contrast, almost all canoeists encountered boats, and two-thirds objected, suggesting that conflicting types of recreation are a more serious problem at present.

THE CAPACITY OF THE QUETICO-SUPERIOR AREA

In 1959 the Forest Service, in connection with a nationwide survey of recreation resources, estimated the capacity of the Boundary Waters Canoe Area. They estimated subjectively that 1.75 acres (land and water) were necessary for each visitor-day per year, indicating a total capacity of about 600,000 visitor-days. This would permit about a 50-percent increase in use over 1961, when the estimated visitor-day total for June 11 through September 9 was 319,000 and for the entire year about 400,000. No assumptions were given as to the composition of use or the level of satisfaction, except the clear implication that this level of use would provide a generally satisfactory wilderness experience.

In the study conducted by the author in 1960 and 1961, sufficient data on use and visitors' attitudes were collected to permit some estimates as to what, in the visitors' opinions, constitutes overuse. These estimates are based on specific assumptions. The assumptions and estimates are presented below.

Assumptions Made in Defining Capacity

The capacity of any recreational area is a complex concept;[6] specifying its magnitude, even very generally, requires a number of assumptions. One set of assumptions involves satisfaction — how much satisfaction for whom? The variation in sensitivity to crowding both within and between user types eliminates any simple standard, either of amount of use or its composition. For example, maximizing the canoeing capacity of the Boundary Waters Canoe Area would require reducing the motorboating capacity to zero; and maximizing the motorboating capacity would eliminate wilderness canoeing. Furthermore, using the interior areas to capacity would lead to overcrowding of the trunk routes used to get there. How should such areas of overuse and underuse be balanced? A similar problem exists with peak periods of use.

Against this background of difficulties, capacity will be considered first in terms of the present combination of uses; then the possible effect of eliminating motorboats from some of the area will be investigated.

Our first assumption is that the paddling canoeists are the critical group in establishing the area's capacity. As the name Boundary Waters Canoe Area indicates, and as the 1948 plan of management makes clear, canoeing under wilderness conditions is the top priority use, with motorboating at best tolerated where it is already firmly established. Since canoeists consider areas overcrowded at much lower levels of use than do any other types of users, full capacity for canoeists would be less than full capacity for others.

The graph relating use to wilderness perception of the paddling canoeists (fig. 10) indicated that on lakes without boats, almost all the canoeists felt themselves in the wilderness if use was under something around 300 groups for 3 months. Also, meeting one party a day was acceptable to 83 percent of the canoeists, and 77 percent could take two groups a day. In an area (a large lake or group of small lakes) used by 300 groups during the main summer season, the expected frequency of encounter would probably be between one and two parties per day. Where motorboats also used the lakes, even the most lightly used lake was considered wilderness by only about half the canoeists, and most canoeists said they could not meet any motorboaters without loss of the wilderness atmosphere. Again, these two measures seem consistent. Both of these thresholds are approximations at this stage and should be regarded only as indicative of the general range.

[6] *For a general discussion of this problem, see Wagar, 1964.*

It is estimated, then, that the threshold of overuse is reached in most areas without boats when they are visited during the season by more than 300 groups of canoeists. This is the threshold at which "full wilderness" begins to be lost. "Most areas" is specified because some variation is probably desirable; some areas should probably be visited by only 100 groups or less, to provide places for people who value solitude highly. However, even if all access points were used by 300 canoeing groups, there would still be many areas within 2 days' paddling where other canoeists would seldom be met, particularly at times other than the peak period from the 4th of July through Labor Day.

Our second assumption is that use on the first two lakes on each route could exceed the appropriate threshold. Because most routes branch off fairly soon, maintaining low use at access points would produce more underused interior area than seems necessary or desirable. The lakes beyond the first two were taken as critical; if they had under 300 groups of canoeists and no boaters they were considered underused, and the same designation was applied to the lakes leading back to the access point, regardless of their amount of use. (If the canoe route branched so that there were two or more third lakes and only one was overused, then the first and second lakes leading to both were classed as overused.) Sections of rivers separated by portages were treated as lakes.

We have defined a "full wilderness threshold;" a second, "half wilderness threshold," can also be specified. Half of the canoeists said the wilderness was lost on lakes used by about 600 groups of canoeists (this figure is based on few observations and is presented very tentatively). Where motorboats were found, half the canoeists felt that the lakes were no longer wilderness if used by, at most, 200 canoeing and boating groups combined. These levels also seemed of the same general magnitude as the answers to the direct questions about reaction to numbers met daily. A majority of canoeists complained if they met more than five canoeing groups a day, which would appear as a reasonable expected frequency of encounter for a lake or group of small lakes used by 600 parties during the study period. A lake used by 200 groups, if roughly half were motorboaters, would also seem likely to produce at least one encounter per day with a boat party. Areas beyond the first two lakes where use exceeded these limits were classed as overused.

Lakes and streams used by numbers between the upper and lower limits were classed as transitional. A majority of the canoeists considered such areas wilderness, but many did not.

The thresholds and the classifications of areas can be summarized as follows:

Area classification	*Type of use*		*Level of wilderness*
	Canoes	*Boats and canoes*	
Underused	less than 300	none	"Full wilderness"
Transitional	300-600	1-200	"Half wilderness"
Overused	over 600	over 200	Not wilderness

To repeat, these definitions were applied beyond the first two lakes.

Lac La Croix was singled out for special consideration because it is so irregular and so much larger than any other lake, and obviously could accommodate more users than the average lake. Lac La Croix was directly classed as transitional (it received a 67-percent wilderness score).

The Distribution of Underuse and Overuse

On the basis of the definitions discussed above, large areas in the Quetico-Superior area appear underused (fig. 12).[7] Except for the route north from Basswood Lake, most of Quetico Park was underused. Overuse was more widespread in the Boundary Waters Canoe Area, particularly in the areas east of Ely. The Little Indian Sioux River to the west appears on the map as overused, but this effect was caused by a small amount of boat use. Some important accesses were underused (fig. 12): The Moose River, the Indian Sioux River upstream (south of the Echo Trail), the Stuart River, Nels Lake, Fenske Lake, Crab Lake, the Isabella River, Kawishiwi Lake, Baker Lake, Brule Lake, and Gunflint Lake. The other access points were in the transitional range, although many of them led to some underused routes.

[7] *Throughout the remainder of the study the terms "underused," "transitional," and "overused" will mean as defined in the suggested evaluation scheme presented here, and the modifiers and cautionary warnings will be understood.*

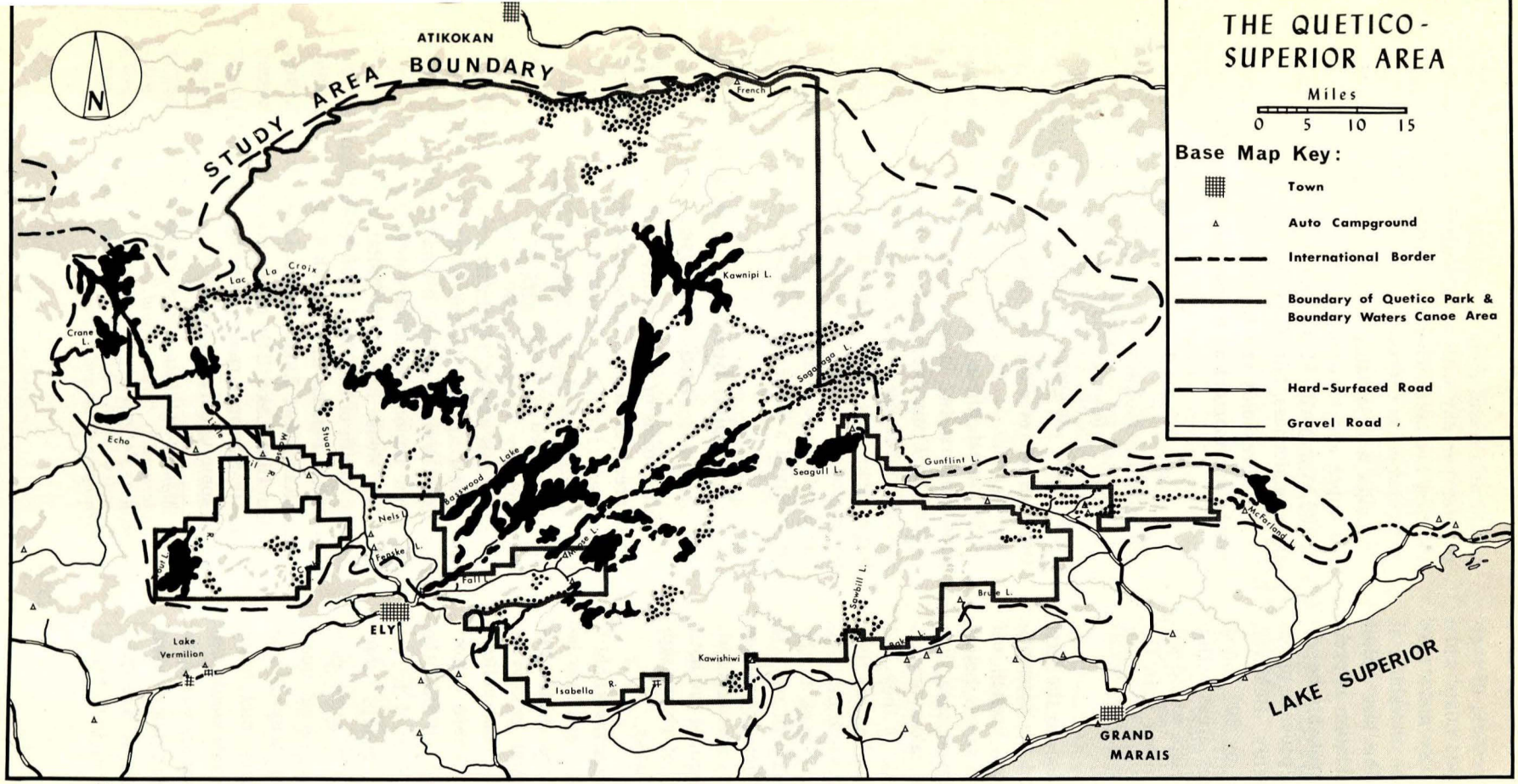

FIGURE 12. — Use in relation to wilderness capacity, June 11 to September 9, 1961.

A comparison of the stricter thresholds (essentially full wilderness) with the amount of use on the underused routes, suggests a potential for about a 55-percent increase in visitors to the Quetico-Superior (over 42,000 additional people). For the Boundary Waters Canoe Area, this would allow for about a 60-percent increase in visitors, with the same combination of types of use, but with a change in distribution as a result of increasing use where it is now light. This only slightly exceeds the National Forest estimate of a 50-percent increase to reach potential capacity.

However, a reduction of visitors in the overused areas to at least the levels at which about half would consider the area wilderness, would almost cancel out the unused capacity; it would allow a net increase of only 5 percent for the whole Quetico-Superior and almost nothing for the Boundary Waters Canoe Area.

It should be stressed again that these results are tentative and that they also depend upon tolerating overuse of the first two lakes on each route. If overuse were accepted on the first three or four lakes, capacity would increase.

If motorboats were eliminated from all areas beyond the second lakes in the Boundary Waters Canoe Area and Quetico Park, the capacity of the area would apparently be increased greatly. If the number of visitors were reduced in the overused areas to the half-wilderness level, and increased in the underused areas to the full-wilderness threshold, net capacity would exceed use by about 50 percent, instead of only 5 as with the present distribution of boats. At a high standard of wilderness environment, the Boundary Waters Canoe Area could still have its use increased about 40 percent instead of almost no expansion under the present mixed boat and canoe conditions.

THE RELATION OF TRENDS TO CAPACITY

How soon might some of the critical use levels suggested in the preceding section be reached, if recent trends persist? This is an important question, but the answer must be qualified. The critical use levels were only first approximations of a difficult measure and inevitably involved certain arbitrary choices. Standards for wilderness could change in the future. Furthermore, the past trends were not very clear, so that any projection should be viewed with even more caution than projections in general.

However, if we make the best of a not-too-good situation and use the figures at face value, it appears that time is short. If all of the future increase in use in the Quetico-Superior could be shifted to the underused points, the full-wilderness level would be exceeded about 1965, based on the past 12-percent annual rate compounded (Lucas, 1964a). The next point, "half wilderness," would be passed only 3 or 4 years later (1968-69). Both these figures are gross in that they assume no reduction at overused points. The dates for the Boundary Waters Canoe Area alone are the same.

Net capacity — capacity after overused areas have been reduced to the upper level — would be reached sooner, of course; even at half-wilderness levels, capacity would be exceeded by 1967. The full-wilderness level was probably exceeded in 1962.

If use of all accesses should increase at the same rate, the underused points as a group would not reach the full-wilderness threshold until about 1975, and the half-wilderness level in 1982. Of course, in 1982 Moose Lake would be visited by about 200,000 people, an almost incredible situation. Before this could happen, undoubtedly many visitors would shift to the more lightly used places and thus shorten their period of grace.

The more reasonable expectation seems to be that full-wilderness capacity generally would be reached between 1965 and 1975, and half-wilderness between 1968 and 1982, if increasing use and resulting dissatisfaction do not depress the rate of increase. But the 12-percent rate can hardly continue; if it does, by the year 2000 over 6,000,000 people will seek solitude in the Boundary Waters Canoe Area.

If motorboats were excluded from the wilderness core, capacity would not be reached as soon. Even then, the deadlines would be moved back only about 3 years because of the rapid increase in numbers of visitors.

SUMMARY

The Quetico-Superior wilderness lakeland has been both preserved and restored. It was one of the earliest areas of wilderness preservation; the two halves of the area, one on each side of the international border, were both established in 1909, and the value of their wilderness character was officially recognized by the 1920's. Inappropriate uses have been progressively restricted since then. The area has considerable social utility because of its location relatively close to the major population concentration of North America, but this proximity also raises the possibility that recreational use will increase until the wild quality is lost.

Capacity — the number of visitors and their degree of satisfaction — seemed to be more a function of attitudes than of physical factors. Attitudes seemed to be related to the craft used — boat or canoe. Canoeists were seeking wilderness, viewed a small area as wild, wanted this area kept undeveloped, and disliked heavy use. However, canoeists seemed willing to accept roughly three times as much canoe use as mixed boat and canoe use. Among other user types, none cited wilderness as an attraction in over half the interviews, although auto campers came close to this level. All user types except canoeists saw a large area as wild, were tolerant of relatively heavy use, and did not differentiate particularly between types of visitors encountered. The friction between users of boats and canoes was thus a one-way affair.

If the assumptions made for measuring capacity in this study are acceptable, then total use in 1961 was only about 5 percent less than total capacity. Because of the unevenness of the distribution of use, however, large areas could apparently be used more often without a loss of wilderness qualities, while severe overuse is found elsewhere. A 55- to 60-percent increase in total use would probably not seriously detract from the wilderness environment if it all occurred at the underused accesses. Eliminating motorboats in the interior would apparently make possible an 80- to 90-percent increase in use.

When past trends are projected and compared to capacity, serious problems appear not too distant. If no access could be overused, full wilderness capacity has already been exceeded. A more realistic estimate places the disappearance of full wilderness between 1965 and 1975. The earlier deadline assumes all increases take place at presently underused areas, and the 1975 date assumes no relative change in distribution. Both dates assume no restriction of motorboats, are aimed at satisfying the paddling canoeists (the most demanding group), and assume adequate provision of access point facilities, such as parking. Levels of use considered consistent with wilderness by the less demanding half of the paddling canoeists would be experienced only a little later — between 1968 and 1982. There would still be some underused access points, lightly used interior lakes, and fewer visitors in spring and fall even in 1982, if the present relative distribution in time and over the area did not change substantially. In effect, if use continues to climb, the wilderness, like a shallow desert lake drying up, will first retreat to the interior, then break up into small isolated areas, and finally disappear, first for canoeists, and considerably later for other types of visitors.

MANAGEMENT IMPLICATIONS

The results reported in this study do not, in themselves, determine the best or right management policies. Assumptions about ends and means are necessary. The ends, in this case, have already been discussed: the provision of a wilderness experience without unnecessary limitation on other economic activities. For the Boundary Waters Canoe Area, the goal is further specified as a wilderness canoe trip experience. These are established goals of public policy, independent of this study.

A Framework for Recreational Policy

The following assumptions concerning the choice of means of reaching outdoor recreational goals have been made:

1. The right to choose a type of recreation must be respected, whether the choice is water skiing or canoeing. This does not mean value judgments may not be made; it does not bar efforts to encourage free choices of more appropriate forms of recreation.

2. A range of recreational opportunities must be provided from which people may choose. This range should ideally be present within an area small enough to provide effective choice; put differently, Alaskan wilderness is not a satisfactory substitute for wilderness in Minnesota. On the other hand, the whole range cannot be available at every location; auto sightseeing and roadless wilderness are mutually exclusive, for example.

3. The provision of a range of recreational opportunities within a large area should take account of the demand for each alternative activity and the requirements of each activity in terms of participants' standards (for such things as the physical characteristics of the area, facilities provided, and other uses of the area, including other types of recreation). Furthermore, to determine the extent of the area needed for each type of recreation, managers must know how users distribute themselves, how use of an area is affected by accessibility to the population, and how best to separate or integrate different types of recreation.

4. In addition to these aspects of demand, the range of opportunities to be supplied should also be based upon knowledge of the number and size of suitable areas — suitable according to the users' standards. Technical feasibility, such as for sanitation or erosion, is also a necessary condition or limiting factor. The types of recreation with the fewest alternative locational possibilities should have priority for the use of a particular area, if other things are equal.

5. Recreationists must know of alternatives — alternative activities and alternative locations — if the free-choice system, which is assumed to be preferable, is to operate in a socially efficient way.

6. Direct regulation of what is meant to be a free and pleasurable part of life is unfortunate, and should not be employed if there is any other way to achieve the desired end.

The Quetico-Superior presents a distinct choice within the range of recreational opportunities — canoeing under near-primitive conditions. It is a choice near one extreme, and although no part of the range is necessarily intrinsically better than any other, this particular opportunity seems to serve a large and growing demand, faster growing than the demand for conventional recreation. It is certainly a minority demand, but the area dedicated to it is only a small part of the Upper Great Lakes region. Canoeists' attitudes indicate that motorboating is incompatible with canoeing in a wilderness, and without priority the opportunity to choose wilderness canoeing would be reduced or lost. The priority is justified for two additional reasons. First, the wilderness qualities of the area were more important to the canoeists than to other groups. Second, a map of recreational areas shows that the canoeists have fewer alternative locations. Visitors also saw the matter in this light. All parties were asked, "Are there any other parts of the United States or Canada which you would consider as suitable for the activities you like to do here?" There were no reported substitutes for 78 percent of the paddling canoeists, 62 percent of the motor canoeists, and 57 percent of the other visitor classes.

Major Present Policy Problems

If the present use of the Quetico-Superior is evaluated in relation to the given policy objectives, one central problem stands out: redistributing

use. There are two aspects to this redistribution: first, shifting at least some people from heavily to lightly used areas, and second, separating conflicting uses, which primarily means keeping motorboats away from canoes. Separating the motorboats from the canoes may be more important; one motorboat seems to equal at least three canoes, from the canoeists' point of view, partly because boats destroy their wilderness and partly because motorboats will be observed by far more groups than will canoes because they travel farther and make more noise. Simply dispersing all use to reduce local crowding without separating the two incompatible types would appear to be a mistake; instead of solving the problem it makes it more widespread.

Separating motorized canoeists from paddlers is a less serious problem, although it affects a larger area.

Limiting the amount of use is not now a major problem, except locally, but within 10 years the situation will probably become critical. Even now, a thorough redistribution of use would leave no unused capacity unless boats were excluded from the interior.

A Suggested Approach to Use Separation and Dispersal

Separation

A possible approach to use separation seems to be a system of concentric zoning. The recreational development of the Border Lake region already has a concentric quality — first comes the developed fringe, then the wilderness used for timber production, and in the core the no-cut zone — but this ring approach has additional potential.[8]

Concentric zoning may have possibilities for increasing the satisfaction of the canoeists, who are more sensitive to crowding and competition, without decreasing the satisfaction of the other, less sensitive, motorboating visitors. Two factors especially seem to make concentric zoning feasible: (1) motorboaters view a much larger area as wilderness than do canoeists, and (2) the distributions of the two uses are quite different. Although it may be justifiable to assign priority to canoeists in the Boundary Waters Canoe Area, this does not mean that boaters need to be excluded from all of their wilderness. Three zones are suggested:

1. *The general recreation zone.* — This is the outermost zone. It would permit and encourage a wide range of activities that do not require a wilderness setting and that are largely incompatible with those uses depending upon the wilderness environment. This is the place for water skiing on large lakes and for using 100-horsepower motors. Although this area has not been studied, tolerable use levels are probably high. At present, all land outside the Boundary Waters Area and Quetico Park is, in effect, so zoned.

2. *The "wilderness" motorboating zone.* — This zone does not now exist. It lies inside the general use zone, closer to the wilderness core. It might correspond roughly to the area outside the Boundary Waters Canoe Area, which over half of the various boating classes considered wilderness (fig. 8); it was seldom visited by canoeists, and they did not think of it as wild. The outer part of this belt lies outside the study area, and visitors there were not interviewed. Consequently, the boundary between this wilderness boat zone and the general recreation zone is undefined at present.

Wilderness motorboating ("wilderness" in the boaters' terms) could be vigorously encouraged here. The zone could even be given a name, perhaps something like, "Superior Motorboat Backcountry." Most new auto campgrounds and all new boat access points would be developed in this zone, rather than at the end of the roads where the canoe routes begin. (Most boaters did not consider campgrounds and launching ramps inappropriate in a wilderness.)

There are lakes in this zone with few or no access or camping facilities; these could provide a high level of enjoyment for many motorboaters without detracting from anyone else's pleasure. Some lakes have resorts and private cabins but no campgrounds and inadequate public access. Other lakes now have very little use of any kind, and could be developed for a more primitive type of motorboating. Some in this last group could be

[8] *Concentric zoning has also been suggested generally as an approach to regional recreation planning (Carhart, 1961; Outdoor Recreation Resources Rev. Comn., 1962; and Wildland Res. Center, 1962, p. 303). The relation of access to concentric zones is critical, however. Visitors desiring the inner zones might be forced to travel through outer, to them unattractive, zones, thus defeating the very purpose of zoning — separation of incompatible uses.*

zoned to exclude buildings, and could be developed in part for boat camping away from the road ends.

Confining new developments to this zone conforms to the Forest Service policy of excluding motorboating within the Boundary Waters Canoe Area where boating is not well established.

To further preserve a genuine opportunity for a wilderness experience for boaters, very large, powerful boats and the associated activities should probably be eliminated here. However, the Forest Service may lack authority to directly control navigation, which is a function of the State government. Minnesota State Parks, for example, regulate boat power and speed.

Apparently boaters willingly accept a relatively high level of use in their wilderness; therefore, the use potential of this ring is probably high — high enough to absorb the increasing boating use under high-quality wilderness conditions in the foreseeable future, especially since boating is not expected to increase as rapidly as canoeing.

3. *The Boundary Waters Canoe Area.* — This zone's boundaries have already been administratively defined. Wilderness canoeing is the top priority use and would be the only use encouraged. New launching ramps for trailered boats and most campgrounds would go in the second zone, not here. Much of the Boundary Waters Canoe Area is now used by motorboats; in fact, much of it is dominated by boats (**Lucas, 1964a, Plate XI**). If the goal of maintenance by the Federal Government of one place in the United States for wilderness canoe travel is taken seriously, this boat use seems undesirable since motorboating is incompatible with wilderness canoeing.[9] Exclusion of motorboats generally within this zone may not be necessary immediately, but it does seem desirable to limit the use of motorboats on interior lakes in the Boundary Waters Canoe Area. This limitation need not be by direct policing. It is the truck and rail portages that make possible the heavy boat use — in fact, boat use almost cuts the Boundary Waters Canoe Area off from Quetico Park. If the mechanized portages are left, public money spent to remove resorts and cabins in order to eliminate inappropriate recreational uses will have been ineffective.

The storage of boats over portages where the land is federally owned will soon be prohibited. Enforcement of this regulation should reduce the penetration of motorboats into the interior.

The rapid decline in boat use over unmechanized portages would indicate that if the truck and rail portages were eliminated and if boats were not stored within the Canoe Country, the friction zone could be reduced to little more than the first and second fringe lakes, which canoeists quickly leave behind.

A map showing the areas where boat use is not established and is therefore prohibited under established policies would help implement the policy.

A restriction on outboard motor power seems even more necessary and justified within the Boundary Waters Canoe Area than in the proposed motorboat wilderness zone. Large motors[10] are unnecessary for fishing, sightseeing, or boat camping — the only boat uses enhanced by a wilderness environment. Not only canoeists, but also many motorboaters would welcome a size limit.

Separating the canoeists who use motors from those who paddle may also be desirable, though less urgent. But such separation is not as easily achieved as for motorboaters; areas of use overlap much more. This problem is not expected to intensify quickly, since motor-canoeing seems relatively slow growing. The Boundary Water Canoe Area policy permits the use of motors on canoes "on the main routes where such use has become accepted as a common means of transportation" (U.S. Forest Serv., Superior N. F., 1948, addendum). The map in the previous study (Lucas, 1964a) showed large areas where motor canoes were scarce; these data could serve as a guide for implementation of the policy. If a no-motor area were established, it could be considered either a fourth zone, similar to the interior no-cut zone, or a sub-zone of the Boundary Waters Canoe Area.

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[9] *Motorboat use is also considered to be the major detraction from the Canoe Area's wilderness qualities in the Wildland Research Center's study, 1962, p. 10.*

[10] *Resorts rent motors up to 10 horsepower but rarely larger. About 32 percent of the motors used by sample parties were 12 to 75 horsepower. Boat campers and private cabin users were the only types frequently using large motors.*

This three-zone approach seems to be generally consistent with the findings of this study. It should reduce the conflict between boating and canoeing, or at least limit its spread and intensification. At the same time, it seems to meet the requirements and desires of most boaters as effectively as access to the heart of the Canoe Country. The differing wilderness images are not the only findings supporting this conclusion. A second, the fact that wilderness qualities were less important to boaters than to canoeists, has been mentioned. Fishing outranked wilderness as an attraction for boat campers, resort guests, and private cabin users. Scenery also took precedence over wilderness for resort guests and private cabin visitors. Third, boaters had less definite reasons for choosing their routes, and even were sometimes uncertain where they had been; therefore, there should be little reduction in satisfaction associated with using one lake rather than another.

The same general zoning approach would probably be suitable in Canada.

The Feasibility of Concentric Zoning

The findings of this study also suggest that the zoning approach is feasible, although not without problems. The use distribution analysis in the previous study (Lucas, 1964a) suggests that the wilderness boat zone development would be most successful and deviate least from present use patterns for auto campers, whose use was only weakly related to location characteristics. On the larger lakes particularly, if wells were provided, substantial use and high satisfaction would be expected. In fact, even on small lakes, if drinking water is provided, as much use per campsite as is usually thought desirable would be expected. This ease of redistribution is fortunate because auto camping seems to be rapidly increasing. The lakes of the proposed wilderness boat zone appear to have ample capacity for a large number of auto campers, especially if several small- or medium-sized campgrounds were located on larger lakes.

On the other hand, redistribution of auto campers would not provide as much relief for the canoe campers as their number would indicate. Auto camping is not as incompatible with canoeing as some other types of use; it is extremely peripheral and the least boat-oriented of any recreation uses except canoeing.

Boat camping would probably be less easy to shift because it is less dependent upon a fixed development than is auto camping. Furthermore, boat campers have pronounced likes and dislikes. Lakes away from Canada — even if large, on major routes, and with direct access —were not heavily used. Small lakes were rarely used. However, the Crane-Sandpoint-Namakan Lake Area, already the most popular location for boat camping, is in the proposed boat wilderness zone; and here and on huge, complex Rainy Lake the potential for expansion is great. In addition, Lake of the Woods and many lakes in Canada provide excellent alternative areas for boat camping. The resistance to shifting use is unfortunate because this class of visitor penetrates fairly deeply with powerful boats, and is therefore more incompatible with canoeing than most other types. However, the expected rate of increase is low.

Any effort to encourage prospective boat and auto campers to use the outer lake zone will require making them aware of the alternative areas through maps, pamphlets, road signs, newspaper articles, and the like. These groups are above average in education, especially the auto campers, and should be able to make good use of the information. Without these aids, they are not likely to sort themselves out in a way consistent with the land management goals.

Day-use is so strongly related to the distribution of population that shifting it much would be difficult. However, it is a minor use, and its growth is slow.

Resort and private cabin use depends largely upon privately owned land, but is subject to some control by the public agencies. The counties have general zoning authority, and within the Boundary Waters Canoe Area the Forest Service has authority to eliminate these two types of use of private land. Outside the Canoe Area, the Forest Service has leased sites for both cabins and resorts, but has generally stopped issuing new leases.

Nearly all canoeing is already within the inner zone, and no change is necessary to separate uses.

In addition to informing visitors of alternative areas, an education campaign to suggest alternative ways of viewing the resources of the area might be worthwhile. For example, a view that is broader than fishing and that includes contemplative travel

through wild, scenic areas as an end in itself could be presented. Conceivably, some speedboating might be tempered by pointing out the special character of the area and the basis for canoeists' objections. A number of motorboaters indicated no knowledge of the existence of the Boundary Waters Canoe Area and its policies, and almost all seemed unaware of the canoeists' resentment of them. Motor canoeists may have overestimated the difficulty of paddling a canoe and overlooked the advantages, such as quiet observation of wildlife and lighter loads on the portages.

Dispersal

Dispersal of users — reducing the extremes between overuse and underuse — is apparently needed at this time only for canoeing. No other use is so unevenly distributed at access points. Although canoeists' use declines slowly away from the starting point and covers all of the area, even in the interior the variation in the number of visitors is extreme. Also, only canoeists seem sensitive enough to present levels of use to be dissatisfied.

The optimum canoe use distribution probably is not a perfectly even spread over the entire area; visitors differ in their perception of crowding. An even spread, in fact, is impossible because of the branching pattern of routes; diversity would exist in the interior even if use of all access points were uniform. However, extremely light use seems unnecessary if enough campsites are available to avoid excessive wear and tear because of concentrations of visitors. Thus it seems that increasing visits to most of the underused areas of figure 12 is desirable. It would probably also be desirable to reduce the number of visitors to the few very heavily used areas; these groups do not appear to be any less sensitive to crowding than other canoeists.

The number of lightly used access points was substantial. Their site and relative locational characteristics were different from those of the popular places. Encouraging modest increases in visits at these little used places seems possible in two ways: first, more people could be informed about the alternative areas. Many visitors are aware of only a few starting places and routes. Canoeists probably would make good use of information such as a map and description of access points and maps of intensity and type of use. The Superior National Forest map shows routes and describes 10 of them, but very few sample groups knew about this map. The new Forest Service Visitor Information Center in Ely may improve visitors' knowledge of alternatives substantially.

Second, some of the characteristics of the locations could be changed. Perhaps permission could be granted for an outfitter's outpost at an underused access point — a place where canoes could be stored, and where an attendant could check cars, at least periodically, to control the occasional senseless vandalism. At some lightly used points where access from the parking area is by a long initial portage rather than directly from car to water, the portage might be shortened. Eliminating the portage altogether might not be wise, however, for three reasons. First, when access points were grouped into classes with similar locational characteristics except for direct access, half of the classes showed greater use where canoes had to be portaged to the water. Second, eliminating the portages could open the areas to boat use, which is very light where direct access is not provided, and thus eliminate the only places where a canoeist can usually escape boats at the start of his trip. Third, elimination of portages reduces the effective wilderness area.

Relative location is also subject to directed change. Canada and Quetico Park are fixed, but the customs and Park entry points are not; changes in their location could help redistribute use in both countries. At present, canoeists cannot legally enter the Park between Crane Lake and Basswood Lake, and on Basswood the location of the second entry point in the central part of the lake (fig. 3) is awkward for canoeists (although well located for the remaining resorts). It is understood that Canadian officials may move this second entry point to the west on Basswood Lake after the removal of all resorts. If this is done, visitors could use several routes to Quetico more effectively. If, in addition, a customs office could be added to the eastern Lac La Croix Ranger Station, the routes on the three rivers crossing the Echo Trail would become more attractive and more canoeists could enjoy the lightly used western part of Quetico Park, rather than all crowding through Prairie Portage.

New access points for canoes could help to change use patterns, but with so many existing

points used so little it does not seem to be a pressing need, with two possible exceptions: One is in the west, where most of the area south of the Echo Trail lies almost unused. Public access to this area is very poor from the southeast, a natural entry point. The other area is west of the Gunflint Trail. A number of rarely used good routes go south and west from Poplar Lake especially, which has many resorts but no public access.

Small lakes in general, or small rivers, might be considered for any new canoe access points. Few boats used such waters, even where there was direct road access. Canoeists did not use the small lakes much either (they used the rivers more), but an access point on a small lake leading to an attractive, lightly used area might draw the desired amount of use, say 200 groups a season, if canoeists knew about it.

One other means of providing an opportunity for canoe camping in solitude — cutting new portages to the many smaller lakes off the "through routes" — is already being pursued, and seems useful. But canoeists should be informed of these possible side trips; most of the current maps tend to emphasize the main routes, and available navigational maps are 10 years out of date.

Besides education and changes in the area, direct limits on numbers of groups admitted could lead to a major redistribution if each access point had a quota. The general question of direct limits will be considered in the next section.

Other Policy Considerations

Conclusions from the study apply to other policy decisions besides those relating to the main problem of use distribution and separation.

Limiting Amounts of Use

There may be some Malthusian-type of minimum-satisfaction carrying capacity, beyond which discontent stops increased use, at least of the types for which the area is intended. This appears as unattractive as Malthusian population control. Other controls of use seem preferable, even unwanted direct limitation.

It would probably be easier to put a ceiling on use before it reaches too high a level than to cut it back afterwards. Therefore, in view of the rapid expected increase in visitors, the time to plan for the desired amounts of use and for methods to hold numbers to this level is soon.

This study has suggested tentatively the levels of satisfaction associated with different amounts of use, which any policy decision should consider; but it does not indicate which level of satisfaction should be the goal. No present data tell us if a "full wilderness" experience for 100,000 canoeists yields greater total satisfaction than a "half wilderness" experience for 200,000 canoeists. Perhaps research or some sort of poll of visitors would help. At present, the decision must be subjective.

One possible method of control might involve allowing unlimited use on the first and perhaps the second lakes, but requiring travel permits, issued in limited numbers each week for each access, for travel beyond. Charges for permits would be another possibility. The price might be graduated to encourage use in the off-season and at underused points. Charges could also discourage use by people who do not need or desire the special qualities of the area, if alternatives were provided for them.

Logging

The limited logging policy as now practiced seems to interfere with the wilderness experience of a fairly small proportion of the visitors. Use is light in the areas of extensive logging, however. The hypothesis that use is light because of logging cannot be rejected at present, although most users were unaware of any cutting and thus would not seem to be avoiding it consciously — similar southern areas without logging were also lightly used. The whole question merits further study.

Roads

The road controversy in the past has centered on a choice between good roads or bad roads. This seems to miss the point and, in the opinion of people interviewed, has led to the wrong choice. The real choice seems to lie between good, but low-speed, scenic roads, and the application of through-highway standards to dead-end wilderness approach roads. The study showed that no type of use (except possibly auto sightseeing) was reduced by either road miles from Duluth or miles of gravel road. The obvious choice, therefore, is scenic roads; these might be blacktopped, but need not be the shortest or most level routes possible. Perhaps inbound and outbound lanes could be separated to keep the roads narrow but safe. In

the outer two of the proposed zones, scenic side roads could be developed to deepen the auto sightseer's experience.

Campground Facilities

The desirability of locating future campgrounds in the outer zones has already been indicated. In addition, the people using campgrounds showed strong preferences for small, simple ones that provide privacy. Many people also showed an interest in hiking, an activity perhaps overlooked because of the overwhelming water orientation of the Quetico-Superior. More trails for hiking and better identification of existing trails might be desirable.

Canoe Campsites

The traditional simple facilities on the canoe trails seem to be preferred to "improvements" by most canoeists. Here again concentric zoning seems to offer possibilities for managing the area to accommodate diverse people. The people who dislike picnic tables (some intensely) are the ones who penetrate farthest; and conversely the groups that like them are concentrated in the fringe. Tables would seem undesirable after the first lake or two; and, even on the margins, some campsites could be left without tables.

Fireplaces are sometimes needed to encourage building fires in a safe location, but the simple ring of rocks, which any portage crew can build in a few minutes, seems to be liked better than the iron and cement structures, and it is much cheaper. Of course, people may move the rocks. On the other hand, if they do not like the fabricated concrete fireplace they will quickly build a ring of rocks anyway. The simple box pit toilet and garbage pit were never objected to in interviews.

Portages

Simple portages seem to be satisfactory. Docks could also be eliminated after the first few portages.

A FINAL COMMENT

An increasing number of Americans feel that outdoor recreation is an important part of a high standard of living. Social scientists in many disciplines are also beginning to take a greater interest in leisure behavior and, within this general interest, in outdoor recreation.

The approach used in the two Quetico-Superior studies was simple. The distribution of the use of the recreational resources of the Quetico-Superior area was described and analyzed, and an attempt was made to learn how the users viewed these resources. Much of the apparent dilemma of contradictory desires by diverse visitors disappeared when their ideas and their geographic distribution over the area were studied. This combination of distributional and perceptual study seems well suited to research in the ill-defined field of conservation, and it is particularly appropriate for consideration of recreational land use. It could lead to a more flexible view of wilderness resources and a higher return from wilderness everywhere. Maintaining flexibility is usually hard, but the alternative may be Leopold's "self-defeating wilderness preservation."

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